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JOHN A. HILL, President and Treasurer.
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FRED J. MILLER, Editor.

FRANK RICHARDS,
F. A. HALSEY,
EDWARD P. BUFFET,
} Associate Editors.

Representatives of Business Department.

ANGUS BALLARD, for New England.
JOHN MCGHIE, for Middle States.
WILLIAM R. WALLIS, for the West.

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Manufacturers on the Defensive.

The agitation and strikes among machinists in Chicago and elsewhere have aroused the fears of manufacturers that if preventive measures are not taken a state of affairs may ensue like that in England two years ago. There has existed for several months an association of manufacturers, having headquarters in New York, called the National Metal Trades Association, which was formed as an offset to the associations among workmen, and similar leagues of manufacturers exist in Chicago and other cities throughout the country, subsidiary to or in harmony with the one named. They are composed of much the same manufacturers, meeting for quicker action than through the national body. One of these local leagues of manufacturers, including only machine shops of New York and New Jersey, was organized at a meeting held in New York Wednesday, March 14. It is called the Machinery Manufacturers' Association. It is not the desire of the local association of manufacturers, at least, to antagonize their own workmen, but rather to combat the aggressive policy of the union leaders. As yet no definite action has been taken by this new association.

It may be said in addition that there is a willingness on the part of a greater or less number of the manufacturers to concede to machinists a nine and a half or a nine-hour day, if they can do so voluntarily. Advocates of this course are talking it up, and the result of their influence upon their fellow manufacturers should be awaited with interest. This plan to concede a shorter day, however, is more or less independent of the aims of the Machinery Manufacturers' Association. It seems to be the desire of those who are in favor of carrying out this policy to do so at such a time and in such a manner as to not lay themselves open to the charge of having been forced to take that action by the labor organizations.

The news from Chicago of the failure of the International Association of Machinists to agree with the National Metal Trades Association at their conference, last week, and of the intention of the former to order a strike in all parts of the United States and Canada puts a serious face upon the industrial situation. History may be made rapidly in the next few days.

Oxygen, Nitrogen and Carbonic Acid from Liquid Air.

At the Engineers' Club, of this city, Professor Pictet, of Geneva, Switzerland, delivered a lecture on the evening of March 15, on his latest discoveries and inventions in connection with liquid air. The lecture was in French, and the interpreter was far from happy in explaining the lecturer's words. The audience was, in fact, quite mystified for a time, and only succeeded in getting at the facts at all through a good deal of pertinent questioning. The substance of the matter is as follows:

The evaporation of liquid air, as is well known, is a distilling process. The nitrogen being more volatile than the oxygen, it evaporates first, leaving a liquid behind which becomes constantly stronger in oxygen—the process being analogous to the distillation of alcohol. Ultimately the solution comes to have a strength of about 98 per cent. pure oxygen, with, of course, the carbonic acid and water of the air in frozen form. This of course furnishes a possible means of separating the oxygen and nitrogen of the air for industrial purposes. The new feature, as we understand it, is the utilization of the intense cold due to the evaporation of the liquid in making more liquid. When a fresh supply of air is subjected to this cold, but 15 pounds gage pressure is necessary to liquefy it in quantity exceeding that with which the operation began. In other words, with an initial supply of liquid air, a consumption of sufficient power to compress additional air to 15 pounds will result in its separation into its constituent gases. There is some uncertainty about this pressure, both 15 and 50 pounds having been mentioned. The probability is that 15 pounds is the theoretical figure under the most favorable conditions, but that higher pressures are needed in practice; these pressures running up to 50 pounds as a maximum when the conditions are unfavorable. The carbonic acid is separated from the oxygen by a filter, or it is left behind as a residuum after the oxygen is evaporated, and, being placed in a stopped bottle, soon liquefies, and is so preserved. The water is eliminated by subjecting the air to the cold of a refrigerating machine before compression.

There is already some demand for liquid carbonic acid and for oxygen, and this demand is expected to largely increase with this cheapened source of supply. It was asserted that recent discoveries have shown that nitric acid and ammonia can be made direct from nitrogen, and this is expected to furnish a market for the nitrogen made.

The initial supply of liquid air must, of course, be made by the older method, though it was stated that this has now been so perfected that a pressure of 1,200 pounds only is needed, and under the most favorable conditions this is reduced to 800 pounds.

Our readers will be glad to know that Professor Pictet has decided to become an American citizen.

It was stated in the course of the evening that liquid air is now made at a cost of twenty cents per gallon, and that all that can be made is readily sold to professors and others, for purposes of demonstration, at a charge of five dollars per gallon.

A Practical Aid to Self Help.

The H. W. Caldwell & Son Company, of Chicago, send us a copy of the notice below, which has been posted in their works, and which explains itself. To our

mind, the best part of the notice is that in which any philanthropic or good-will aim is disavowed, the frank statement being made that the company does this because it expects to profit by it. We have no doubt that the actual result from the good-will standpoint will be more favorable than it would have been had the opposite course been adopted. The company inform us that the response to the offer was highly satisfactory:

NOTICE.

"We believe that a number of our employees would like to take regularly one or more of the technical papers published in the interests of the machinist's trade, and as we believe that an active and intelligent interest by our men should be encouraged and would result in quite as much benefit to ourselves as to them, we are willing to do our part in placing such trade papers in their hands. We are willing to pay half the cost of subscription to any trade paper that any of our employees may select, and in making this offer we do so, not in the nature of a gift, but believing that our share in the benefit will be fully equal to that received by the men.

"In case the number of subscribers to any one paper is enough to secure the benefit of club rates, the amount of subscription paid by the men will be one-half of such club rate and not one-half of the full subscription rate.

"The 'American Machinist' probably stands at the head of machinists' papers in this country, but our offer extends to any trade paper or papers that may be selected.

"Anyone wishing to take advantage of this offer will please notify Mr. Sisson or Mr. Wright."

Legal Notes—An Accident in a Paper Mill—Fencing Dangerous Machinery.

BY W. M. SEABURY.

The action brought against Alexander M. Orr and others by Charles M. Wyman, Jr., was recently decided by the Appellate Division of the New York Supreme Court, in the Third Department.

The defendants owned and operated a paper mill in the city of Troy, N. Y. The plaintiff, who was a boy of fifteen years of age, was employed by the defendants to pick up waste paper around the machinery. He had never worked around machinery of any kind before, and he was given no warning or instructions as to the dangers of the position. The machine about which he was working was of the kind ordinarily used in most of the paper mills in the country, and it became necessary for the plaintiff to go in between two rollers or calenders to pick up the "broke," or waste, paper. The rollers were revolving with sufficient rapidity to calender from 180 to 200 feet of paper per minute, and there were no guards to the machinery.

The boy stooped over and picked up an armful of paper, and as he was backing out from between the two rollers he was suddenly jerked around, and the paper together with his arms was carried through the calenders, his arms being so crushed that amputation of both of them was necessary.

It appeared that the operation of the machinery generated an electrical current between the two calenders which had a tendency to draw the paper so gathered to the machinery. The trial court directed a verdict for the defendant upon the ground that the dangers attendant upon the operation of these calenders were so evident and obvious that if not seen by the plaintiff then as a matter of law he was guilty of contributory negligence, but the Appellate Court, Kellogg, J., dissenting, held that under all the circumstances, taking into consideration the age and occupation of the boy, and the nature of the force in question, the trial court could not say as a matter of law that it was an obvious and apparent source of danger, the risk of which plaintiff assumed, and for these reasons the judgment should be reversed and a new trial ordered.

FENCING DANGEROUS MACHINERY.

Elizabeth M. Byrne, a girl of fifteen years of age, was employed by the Nye & Wait Carpet Company to pick the carpets and darn them if any loose threads or holes appeared. In another part of the room where the girl worked there was a machine called a "shearing machine," the purpose of which was to trim and cut the nap off carpets after they were manufactured.

Some knives were placed upon the cylinder of the machine, and including these knives the cylinder was about 5 inches in diameter. A carpet was being run through the machine, and as the girl passed the machine she noticed that the carpet was drawn in such a way as, if not adjusted, would result in its damage. She thereupon undertook to press out the crease and to pull the carpet so that it would run through the machine properly. In doing so her fingers were drawn into the knives and four of them on her left hand were cut off.

Her father brought suit against the company, claiming that the failure to place guards about these knives was a violation of section 8 of chapter 409 of the Laws of 1886, an act amended by chapter 673, Laws of 1892, which provides that the owner of any manufacturing establishment shall "properly guard machinery of every description."

The Supreme Court in Cayuga county dismissed the complaint, and the plaintiff appealed to the Appellate Division, Fourth Department.

In affirming the judgment of the trial court Mr. Justice Smith, rendering the opinion of the Appellate Court, said: "The statute does not require every machine to be fenced in. It does not mean that all knives which may possibly be reached in a machine must be guarded. The law requires to be guarded those parts of machinery which, in reasonable anticipation, may be a source of danger to the operatives. It was not within reasonable anticipation that a child at work in a different part of the factory should be attempting to adjust a carpet in a swiftly moving machine which was in no way connected with her work."

The Paris International Assembly.

The first international assembly of The International Association for the Advancement of Science, Art and Education is to be held in Paris during the Exposition of the present year. This organization dates from the September, 1899, meetings of the British and the French at Dover and Boulogne, respectively. The assembly will be spaciously and magnificently housed within the precincts of the Exposition in the buildings of the University of Paris, in the Musee Social and in other buildings granted by special bodies.

The programme of the assembly, which is much too long for reproduction here, contemplates a vast number of "Congresses," with various subdivisions, and with meetings of some of the bodies arranged for daily from the beginning of June to the middle of October.

The Public Utility Association of Bernese Oberland, Interlaken, Switzerland, of which Herman Hartmann is secretary, requests us to publish the following notice: "The Public Utility Association of Bernese Oberland, Switzerland, with seat in Interlaken, just published a gem of a little book of information for the Americans who anticipate a trip abroad next summer. The inquiries of such about the beauties of nature, the railroad and hotel accommodations of the country have been too numerous to be answered individually. The above mentioned association therefore will be glad to mail this richly illustrated book gratis to anyone sending address."

The Mark Flather Planer Company, of Nashua, N. H., refer to our recent illustration of the Stockbridge shaper, and call attention to the fact that in our issue of November 29, 1894, we described a shaper made by them, which shaper had combined in it the Whitworth quick-return motion and the slotted-lever motion. In that article we showed nothing but an outside view of the shaper, however, and the features spoken of were indicated only by a reference to them in the description.

Commercial Review.

NEW YORK, Saturday, March 17, 1900.

THE MACHINE TOOL MARKET.

New York houses report highly satisfactory market conditions as prevailing since the first of the year. The aggregate of sales compares favorably with those of the

winter of 1899. At one house an estimate was given that its sales during January and February exceeded those of the corresponding months a year previous by 15 or 20 per cent. A man connected with another establishment is so overcome with the present activity of trade that he cannot believe in its permanency, and others in various terms add their testimony to the encouraging sum total.

That the demand for machine tools is more active than at any other time within a year past, however, would be a rash thing to affirm, in view of the relative ease with which tools are now obtainable. That light machines are plentiful is already an old story, but there are also indications at some points that the lock in heavy ones is breaking. Large lathes, boring mills, etc., may more easily be found for quick delivery than they once could, if you know where to look for them. Heavy planers, however, hold about as tight as formerly. Milling machines are moving with increased freedom from at least one source.

Among recent purchasers of machine tools in this market has been the General Electric Company, which placed orders estimated at $20,000 or $25,000 for various tools.

The United States Projectile Company, First avenue and Fifty-third street, Brooklyn, N. Y., manufacturer of projectiles, hydraulic forgings, etc., is fitting up one of its large buildings, formerly used by it for manufacturing cold-drawn seamless steel tubing, as a machine shop, the building being 100 feet wide by 300 feet long. The equipment of the shop is not yet entirely ordered, but among the contracts already placed is one for a C. H. Brown & Co. engine of about 300 horse-power, to furnish the main driving power. The company expects to soon be in a position to manufacture all classes of special and general machine and hydraulic work, forgings, etc. They have done much work in the past for the United States Government.

The Watson-Stillman Company, New York, is now carrying on its books a volume of orders believed to be unexcelled at any previous time. Prices have gradually been stiffened as estimates on contracts have been made.

A branch at Pittsburgh, Pa., is to be started by the Berlin Iron Bridge Company, which has made purchases of land for that purpose. It is now at work on the plans for the buildings, which will be quite extensive, designed and built by itself at its own shops. It is intended that this plant shall be fully equipped with all modern appliances for doing all classes of steel bridge and structural work; in fact the company has undertaken in the layout to make it the best plant of the kind in the country. The greater part of the machinery equipment has already been ordered. The capital stock of the company has been increased to $750,000.

NEW MACHINERY FOR THE SPRINGFIELD ARMORY.

Contemporaneously with the publication of the first part of the illustrated article upon the shops of the Springfield Armory, which appears in this number of the "American Machinist," comes to hand an important item of commercial news in the same connection. Specifications for a large quantity of new machinery for the Springfield Armory have just been issued and tenders will be received by the commanding officer there until noon, April 6. There are fifty-one lots in the schedule, and in a single lot are included 66 milling machines. The specifications, abbreviated, are as follows.

Single spindle profiling machine; three No. 1 2-spindle profiling machines; 16 No. 2 two-spindle profiling machines; No. 3 Pratt & Whitney screw machine; 14-inch Pillar shaper, Pratt & Whitney Company's or its equal; two No. 3 bench lathes, 7-inch swing, 32-inch bed; seven three-spindle drill presses; adjustable incline, single action punching press; sixty-six No. 2 milling machines, Lincoln pattern (bids also invited on the Pratt & Whitney No. 2 Lincoln milling machines); five No. 3 hand milling machines; two hand milling machines; slotting machine, 6-inch stroke; vertical shaping machine, Bement, Miles & Co.'s pattern; No. 3 bench lathe, 7-inch swing, 32 inches long; 16-inch planer, Whitcomb pattern or its equal; double saw bench, F. H. Clement Company's improved pattern (now made by American Wood Working Machinery Company); universal milling machine, Brown & Sharpe No. 2 or its equal; four 9-inch hand lathes, 3 feet 6 inches bed; automatic pinion cutter, to cut 4-inch diameter pinions, etc.; engine lathe, 16-inch swing, 8-foot bed; three engine lathes, 14-inch swing, 6-foot bed; four weighted engine lathes, 13-inch swing, 6-foot bed; two 10-inch tool makers' engine lathes, Pratt & Whitney pattern or equal; one duplex drilling lathe; automatic screw, pin and rivet machine; 150-pound Bradley upright cushioned strap hammer; Greene fuel economizer; Gordon Franklin printing press, 11x17 inches inside of chase; combination steam and power pump, capable of pumping 1,000 gallons per hour; one or more exhaust fans, with piping complete; five 175 horse-power boilers; pattern makers' lathe, 24-inch swing, 8-foot bed, F. H. Clement Company's (now American Wood Working Machinery Company) pattern or equal; automatic knife grinder, with cross feed, Rowley & Hermance Company's (now American Wood Working Machinery Company) Perfection pattern or equal; seventeen Pratt & Whitney Company's No. 3 rifling machines; two punch presses, geared, No. 3 style or equal, 3,400 pounds complete; seven barrel turning lathes; bolt cutter, Merriam or equal (Hill, Clarke & Co., agents) No. 4; Brown & Sharpe grinder, No. 1 or equal; two power planers, to plane 16-inch x 16-inch x 3-foot block; power planer to plane 20-inch x 20-inch x 5-foot block; power planer to plane block 24 inches x 24 inches x 6 feet and over; hand lathe, special, swing over bed 12 inches, length of bed 7 feet; two Pratt & Whitney improved gun barrel drilling machines; five drop hammers complete, weight of hammer proper 400 pounds; oil filter, "Warden," Burt Manufacturing Company, large size No. 5; fuel gas plant; two single spindle drill presses, style of Garvin or equal; four single spindle drill presses, style of Garvin or equal; three three-spindle drill presses, style of Garvin or equal; seven lathes for turning gun barrels, with chain feed; band saw, Pratt & Whitney Company's or equal, as described.

CHICAGO MACHINERY MARKET.

In many instances the improved machine tools which have been sold during the past few months have served as missionaries. This fact explains in part the continuously good inquiries. Manufacturers, under the stress of orders which exceeded their producing capacity, put in a modern tool or two, and the economy of operation thereby demonstrated convinced many of them that they could not afford to keep their old equipment of shop, dating back in its purchase a good many years. This is true of iron-working machinery, but doubly so of wood-working tools. It is noticeable in the West that those plants which are equipped by the latest and best labor saving appliances are growing rapidly, while those which cling to tools that have endeared themselves by long association are in a process of greater or less industrial decay. In the iron-working branch, factories which have been engaged in the production of specialties have kept themselves well abreast with improvements in machinery, for their trade has been measurably well sustained through recent years. But the jobbing machine shops have pursued the opposite policy, making the old tools last, because trade did not warrant a reconstruction of equipment.

Conditions are such in the West that the machine tool market is just about maintaining the activity of January and February. If there were annual regularity to the trade, a bulging out of business might be expected at about this time, but so erratic has buying been for years, developing marked and unexpected strength at times, and at other times failing to attain expected activity, that rules cannot be applied. But the fact is generally admitted that the Chicago trade has suffered from the machinists' strike in this city. Several large shops that have closed operations have taken the occasion to make some improvements and alterations in the plant, buying machinery for the purpose. Had the labor troubles not arisen they would have deferred these purchases, on account of the rush in their shops. This buying has offset partially the tendency

of Chicago manufacturers to defer purchases of machinery. But the net result is a decrease in the local trade. Country buying is not unfavorably affected. There are in sight a great many orders for machinery, some of which will probably be placed soon, others awaiting the clearing of the labor atmosphere.

Deliveries on planers continue quite belated. But for machine tools in general the conditions are somewhat easier, not by reason of a slackened demand, but because of increased production. Supply houses are fairly well filled with stock in iron-working machinery, though the same cannot be said of wood-working machinery, for which the demand continues to exceed the supply.

CINCINNATI REPORT.

Among the distinctive signs of improvement in Cincinnati machine making circles the improvements under way at the works of the Bickford Drill and Tool Company, at Front and Pike streets, deserve some attention at the hands of chroniclers of local trade happenings. These constitute almost an entire rehabilitation of the power plant, new boilers and engines and much new auxiliary power equipment. The old power plant was found to be entirely inadequate. A number of machines which have been ordered several months are coming in now, and a rearrangement of the shop is under way to provide room for the balance of the tools yet undelivered.

Harry C. Hoefinghoff, president and general manager of the company, says that within thirty days the company's capacity will have increased 50 per cent. "Our plant this year, if trade continues so promisingly as now," said Mr. Hoefinghoff today at the Business Mens' Club, "should enable us to produce 50 per cent. more work than last. We have orders on hand now sufficient to run us six months easily. Domestic agents placed orders heavily in January and February."

The Bickford people have just brought out a new drill, which is to be placed on the market in the next sixty days. President Hoefinghoff regards it as the best radial drill the company has ever produced. Looking to foreign trade, the Bickford Drill people will have two special exhibits at the Paris Exposition—one of five machines connected with power in the Vincennes section, the other of two machines for inspection merely in Champs de Mars. President Hoefinghoff expects to be present at the fair in person, and will, after it is over, pay the foreign agents a visit ere he returns to America. A new catalog of the Bickford Drill and Tool Company's products will be out in a few days.

Julius Collignon, of Guadalajara, Mexico, has spent several days visiting the machine tool manufactories. He placed a number of orders ere he left. Mr. Collignon regards Cincinnati as the legitimate purchasing center for Mexico and Central America.

Manager D. C. Shears, of the Grand Hotel here, has just been notified that headquarters for the National Society of Mechanical Engineers will be established at that hostelry, and that the convention will be held during the week of May 14.

Mr. Hoefinghoff, of the Bickford Drill and Tool Company, has just disposed of the Hoefinghoff estate's interest in the Hoefinghoff & Laue Foundry Company, and will hereafter devote all his energies to the first-named concern.

There is felt a daily increasing need of better, or rather more extensive, foundry facilities in Cincinnati. Although every one of the several large concerns in the city as well as those of Covington and Newport and the suburbs available for the local concerns using plain and core castings, is running at its full capacity, the supply is inadequate. To this fact the John H. McGowan Company, makers of pumps and pumping machinery, attribute for the most part their delay in getting out their present heavy orders. "We are patronizing every foundry in the city and neighborhood," said an official. "We can get our plain work out, but find difficulty in getting out our orders, because it is so difficult to get core work." The McGowan Company has orders in for pumping machinery for four complete water works plants and for smaller work—more than they can fill for months.

EXPORTS OF MACHINERY.

The "Monthly Summary of Commerce and Finance," compiled by the Bureau of Statistics, United States Treasury Department, for January, 1900, shows metal working machinery shipments for that month of $586,837; for January, 1899, $594,856. For December, 1899, they have previously been reported at $748,654. For the seven months ending January, 1900, they were $4,100,130, and for the seven months ending January, 1899, $3,758,811.

Electrical machinery exports were: For January, 1900, $342,973; January, 1899, $303,702; December, 1899, $385,350; seven months ending January, 1900, $2,138,732; seven months ending January, 1899, $1,692,235.

Printing presses and parts thereof: January, 1900, $113,006; January, 1899, $40,534; December, 1899, $115,024; seven months ending January, 1900, $691,838; seven months ending January, 1899, $428,728.

Pumps and pumping machinery: January, 1900, $266,723; January, 1899, $208,413; December, 1899, $304,536; seven months ending January, 1900, $1,805,825; seven months ending January, 1899, $1,441,524.

Stationary engines: January, 1900, 118, at $85,779 aggregate value; January, 1899, 40, at $31,122; December, 1899, 66, at $38,912; seven months ending January, 1900, 629, at $386,060; seven months ending January, 1899, 286, at $171,525.

Locomotive engines: January, 1900, 49 in number, at $437,702 aggregate value, January, 1899, 38, at $322,683; December, 1899, 22, at $223,500; seven months ending January, 1900, 296, at $3,103,260; seven months ending January, 1899, 315, at $2,949,139.

Boilers and parts of engines: January, 1900, $123,242; January, 1899, $80,659; December, 1899, $134,798; seven months ending January, 1900, $1,056,342; seven months ending January, 1899, $706,885.

Typewriting machines and parts thereof: January, 1900, $210,990; January, 1899, $198,318; December, 1899, $243,245; seven months ending January, 1900, $1,512,986; seven months ending January, 1899, $1,173,156.

Sewing machines and parts thereof: January, 1900, $329,575; January, 1899, $231,240; December, 1899, $415,281; seven months ending January, 1900, $2,556,867; seven months ending January, 1899, $1,619,048.

Cash registers: January, 1900, $66,676; December, 1899, $53,776; seven months ending January, 1900, $487,817.

Quotations.

NEW YORK, Monday, March 19, 1900.

Iron—American Pig, tidewater delivery:—

Pennsylvania Irons:	
No. 1 X foundry	$23 45 @ $23 70
No. 2 X foundry	22 45 @ 22 70
No. 2 plain	20 70 @ 21 45
Alabama Irons:	
No. 1 foundry	22 25 @ 22 75
No. 2 foundry	21 25 @ 21 75
No. 3 foundry	20 25 @ 20 75
No. 1 soft	22 25 @ 22 75
No. 2 soft	21 25 @ 21 75
Foundry forge	19 75 @ 20 25

Bar Iron—Base sizes—Refined, mill price on dock, 2.10 @ 2.25c.; store price, 2.45 @ 2.60c.; common from store, 2.40 @ 2.50c.

Tool Steel—Base sizes—Standard quality, 7 @ 8c.; extra grades, 12 @ 14c.; special grades, 16c. and upward.

Machinery Steel—Base sizes—Ordinary brands from store, 2.85 @ 3c.

Cold Rolled Steel Shafting—Base sizes—From store, 4 @ 4.25c.

Copper—While there is still on the street talk of figures on the basis of 16½c. for Lake, the market is stronger and is quoted by one leading authority as high as the following range: Lake Superior ingot, 16¾ @ 16⅞c.; electrolytic and casting, 16⅝ @ 16¾c.

Pig Lead—Wholesale lots, 4.70c., New York delivery; carloads, 4.72½ @ 4.75.

Pig Tin—In 5 and 10-ton lots, f. o. b., New York, 33½ @ 33¾c.

Spelter—Prime Western, 4.60 @ 4.65c., New York delivery.

Antimony—Cookson's, 11c.; Hallett's, 9¼c.

Lard Oil—Prime City, present make, 51 @ 53c., in jobbing lots.

The United States Armory at Springfield, Mass.—I.

BY D. E. MAC CARTHY AND F. J. M.

The object of this article with accompanying photographs and sketches is to give the readers of the "American Machinist" an insight into the oldest and historically most famous, if not the largest, of Uncle Sam's workshops, and the manufacture of the United States army magazine rifle, more commonly known to the public by the name of its Norwegian and Danish inventors, Krag-Jorgensen.

For the benefit of those who have never given much attention to this branch of our country's business, it may be of interest to learn something of the location and surroundings of the armory before entering into the details of manufacture.

The selection of Springfield, Mass., as a site for the national gunshop and arsenal can be traced directly to Washington, who approved the choice of his ordnance officers in the year 1789, and the spot where he is supposed to have stood when he accepted the site is now marked by a stone slab, suitably inscribed. In the year 1795 the first actual work of the manufacture was begun on the old flint-lock musket, in a rented building on Market street, Springfield. During the next ten years the buildings known as the "Water Shops," on the banks of Mill river, were built, and are at the present time used exclusively as a drop-forge plant and for the complete finishing of the rifle barrel, the bayonet and some other minor parts of the "Krag."

Fig. 1 is a view of the Water Shops, from a point just below the bridge over Mill river, which runs along at the right, parallel with the side of the building, and furnishes power. In the tower of this building is a winding stairway which goes to the top without a break, leaving the central space open, and exactly in the center hangs the bell-rope connecting to a bell cast at the Ames establishment in 1842. The offices for those in charge and for clerks, etc., are on either side of the tower, and the numerous chimneys seen at the right serve the forge room, an interior view of which is given at Fig. 2, showing the rows of drop hammers which in busy times are all at work, but many of which now have their belts taken off and hung above the shafting. There are fifty-two drop hammers in this room, though all of them cannot be seen in the photograph. Besides these are many rolls for barrels, all barrels being here rolled out from shorter pieces of a diameter suitable for the breech end, and the rolls having in them eccentric grooves which give the required reduction of diameter toward the muzzle.

Operations were commenced in 1801 on the site of the present great armory workshops, about a mile from the Water Shops, on a level plateau 160 feet above the Connecticut river, overlooking the city; and here, from an old tower surmounting one of the arsenal buildings, there is a remarkable view of varied and picturesque beauty.

From the days of the old flint lock musket (1795) up to 1892, when the manufacture of the Krag-Jorgensen was begun, fifteen different styles of firearms have been made here, and, up to the present date, appropriations have been made by the Government for real estate, buildings and improved machinery amounting to a total of about thirty-three million dollars. The period of greatest activity at the armory shops was during a portion of the eventful year 1864, when thirty-four hundred men were employed in turning out the phenomenal number of one thousand muskets a day. The buildings were improved and extended from time to time, until in 1889-90 new shops were erected under the supervision of Gen. Buffington, now Chief of Ordnance at Washington, and who was then the commanding officer at the armory. These shops are called the "Hill Shops," but might be more appropriately named "Elm Forest Works," surrounded, as they are, by magnificent old elm trees, whose wide-spreading branches are so woven and interlocked as to almost hide the brick walls of arsenal and workshops.

The photographs, Figs. 3 and 4, are taken from about the only points of vantage to be obtained, the camera being placed inside the high iron-bar fence inclosing the

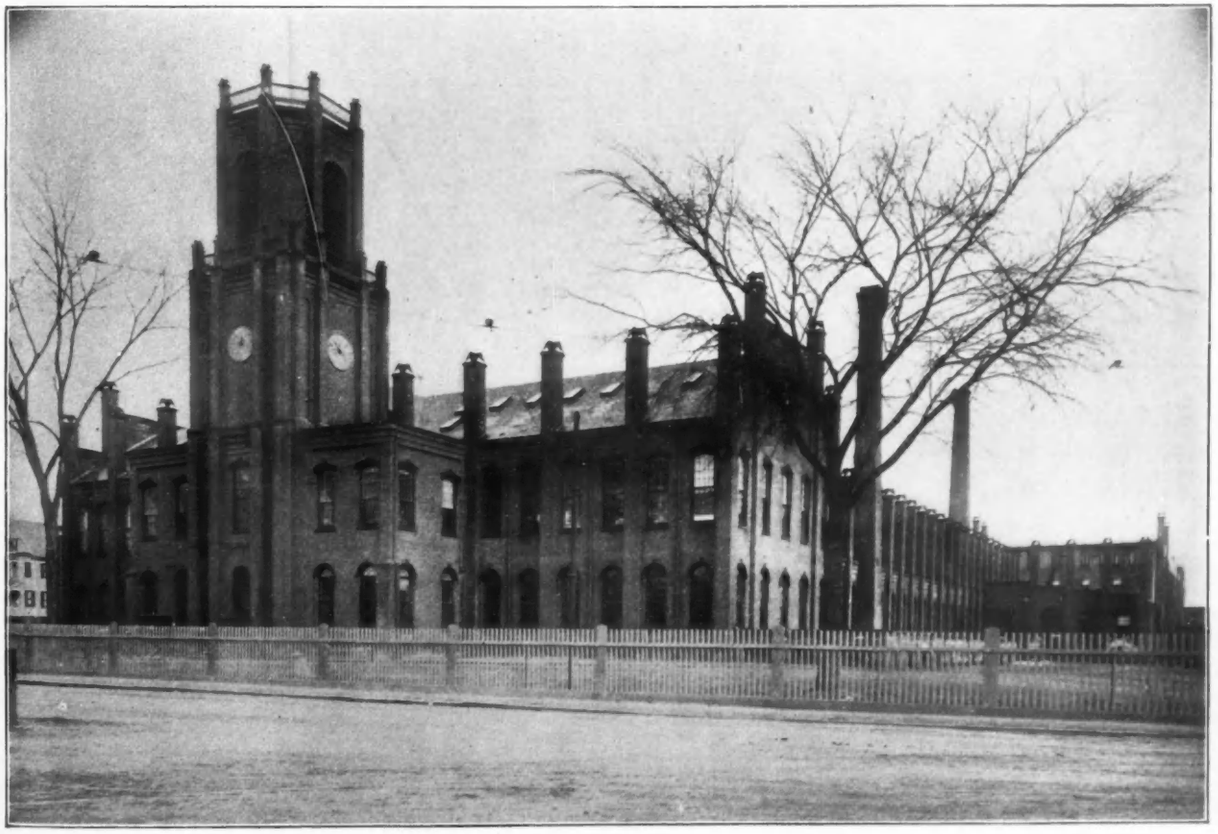


FIG. 1. VIEW OF "WATER SHOP," SPRINGFIELD ARMORY.

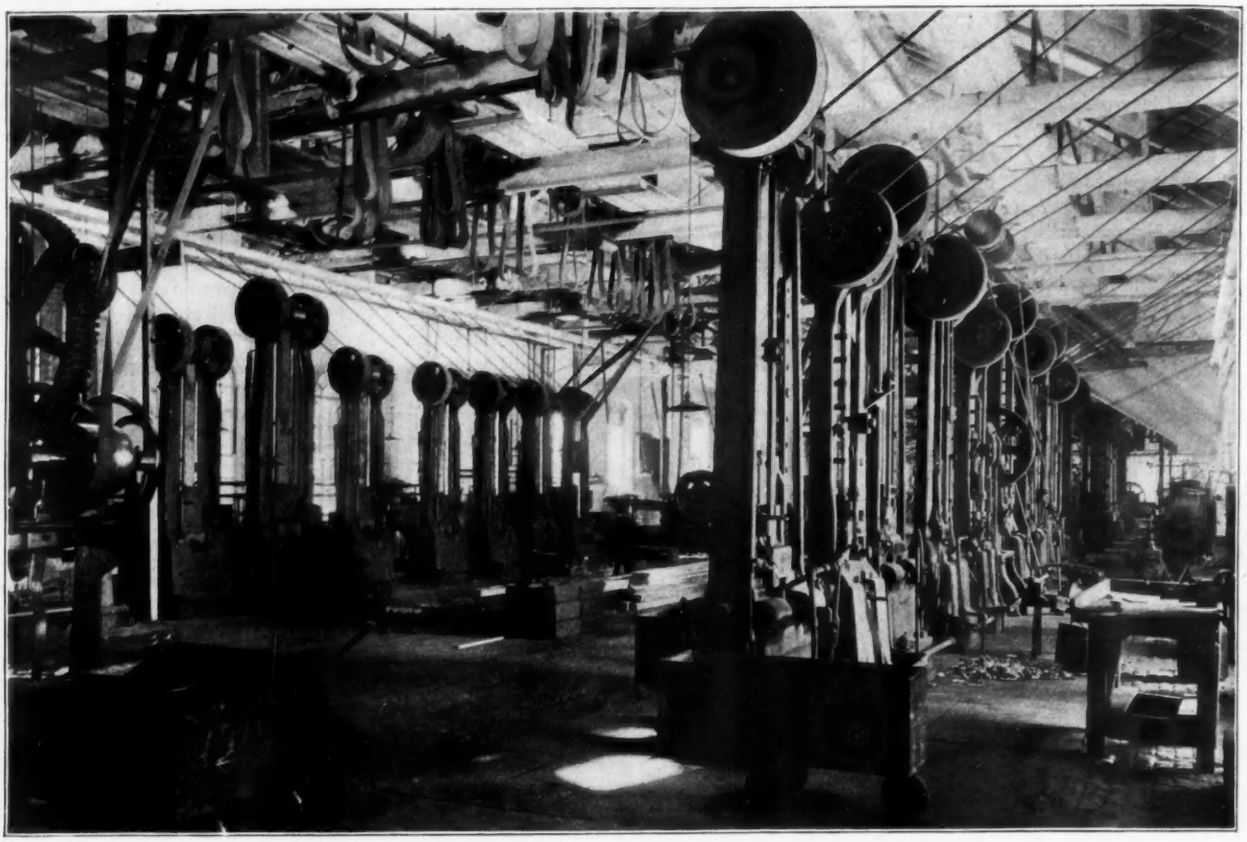


FIG. 2. DROP HAMMERS AT "WATER SHOP," SPRINGFIELD ARMORY.

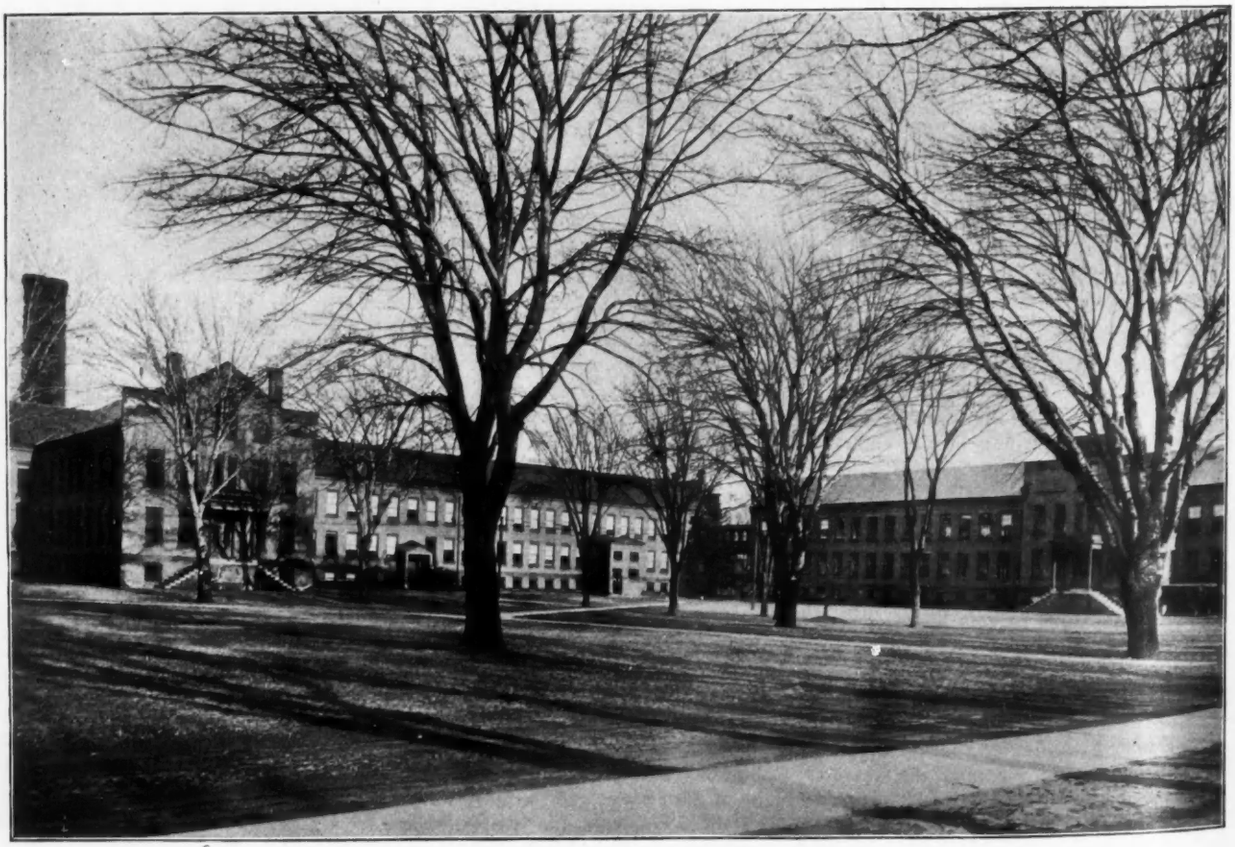


FIG. 3. STOCKING SHOP, FILING AND ASSEMBLING SHOPS AND ENGINE HOUSE, "HILL SHOPS," SPRINGFIELD ARMORY.

FIG. 4. MILLING SHOPS, PROFILING AND MACHINE SHOPS, SPRINGFIELD ARMORY.

FIG. 5. DIE-MAKING ROOM, "WATER SHOP."

grounds, and giving a very good idea of the character of the buildings.

The buildings are surrounded by an expanse of forty or more acres of lawn and fields of waving grass; in the pastures beyond cattle graze, and a fountain playing under the old elms accompanies the music of the birds in the thick branches above.

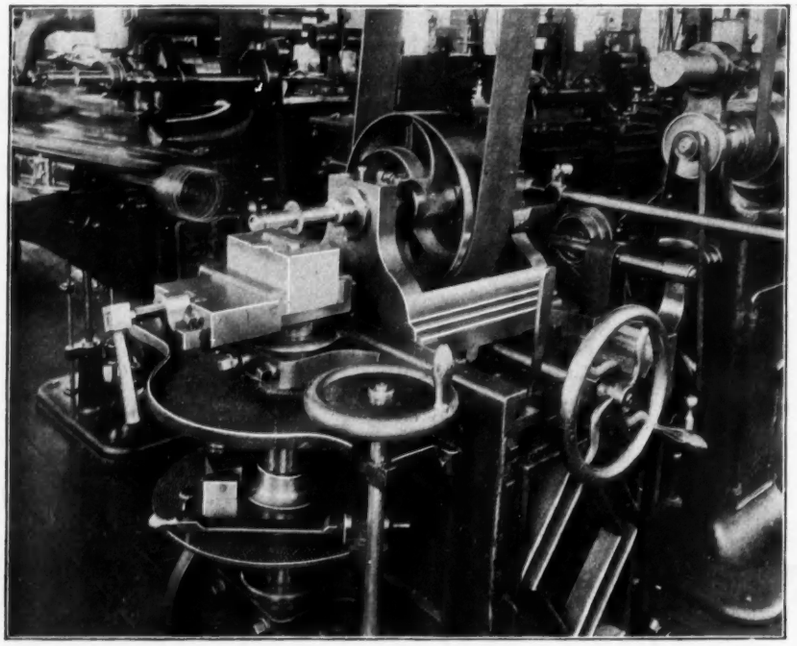


FIG. 6. OLD MILLING MACHINE, "WATER SHOP," SPRINGFIELD ARMORY.

Amid such picturesque surroundings it is not surprising to find men who entered the shops of the armory fifty or more years ago as apprentices, worked on rifles for both our wars, and are now rounding out the years of a contented and prosperous life, finding the eight hours' daily routine but a healthful exercise for mind and body. It is not unusual for a stranger visiting Springfield to admire the handsome garden and grounds of a fine old country residence on upper State street, and to be informed that "they belong to Mr. William Jones, a mechanic at the armory."

During the Spanish war many of the veteran workmen, feeling unequal to the necessary confusion and rush of increased hours of labor, retired to their homes, living in comfort on money at interest in the savings banks, accumulated during the long years of faithful and intelligent service.

With the passing of the older men came the younger element; two shifts of men were employed, and for twenty-two hours out of the twenty-four the old armory echoed with the sounds of unwonted activity. About eleven thousand Krag-Jorgensen rifles were turned out every month. To accomplish this result every available foot of space was utilized for the placing of machinery and men, many new men and improved tools were added, a corps of competent draftsmen designed special tools and machines for both steel and wood work, and tool makers crowded the machine room to its utmost capacity. Notwithstanding the increased force and improved facilities it was found impossible to keep pace with the demands of the Government, and many contracts were given to outside manufacturers.

Much credit has been given to the various army officials who have been in command of the armory, while few, if any allusions have been made to the efficient services of the civilian shop superintendents and foremen.

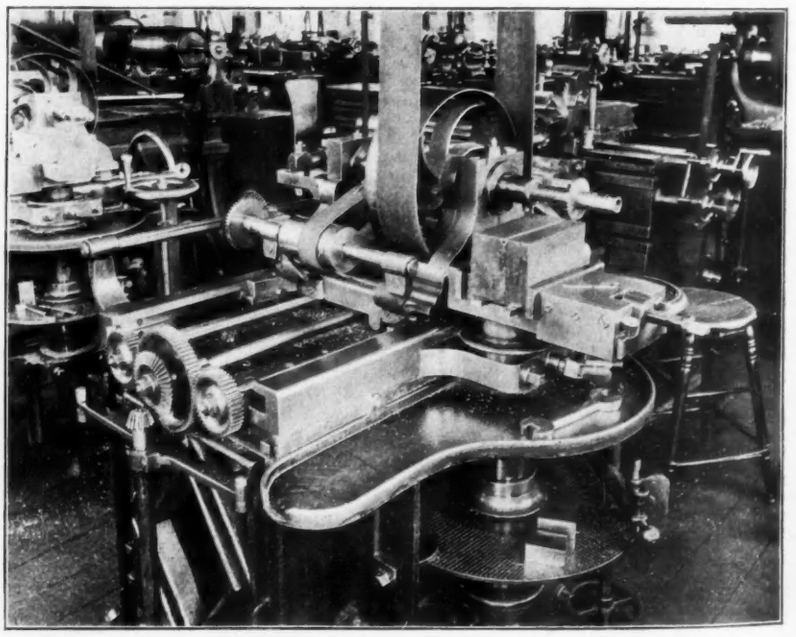


FIG. 7. OLD MILLING MACHINE, "WATER SHOP."

Some of the new machinery and improved methods suggested or designed by Mr. Daniel J. Manning, foreman of the "Hill shops," and Mr. John Murphy, head draftsman, have greatly facilitated the manufacture of the Krag-Jorgensen rifle. Lieut. T. C. Dickson, although subordinate to Col. Isaac Arnold, in command during the Spanish war, should be given a share of the credit for the excellent state of efficiency which characterizes the workshops of the armory to-day. Both of these able officers have been transferred to other posts of duty, and the armory is now under the general direction of Col. F. H. Phipps, as Commandant, who is assisted by various military officers and by P. H. M. Brooks, D. J. Manning and Charles H. Ladd, who are the chief civilians in charge of mechanical work, and are known as General Foreman of the Armory, Foreman of the "Hill Shops" and Foreman of the "Water Shops," respectively. Mr. Brooks' service in the armory dates from December, 1866, and has been uninterrupted, with the exception of a few months' rest following his resignation when the redoubtable Col. Mordecai was in charge of the armory, Mr. Brooks having been reappointed when Col. Phipps took charge.

Mr. Ladd also worked in the armory many years ago, but went as a soldier to the civil war, and was afterward superintendent of the Smith & Wesson factory. Perfect harmony seems to prevail under Col. Phipps' administration, he evidently knowing how to have things go along smoothly and efficiently without unnecessary friction, which, we all know, is one of the most important attributes of a successful manager.

As would naturally be expected, there are very many machine tools in use in these shops that are interesting to-day

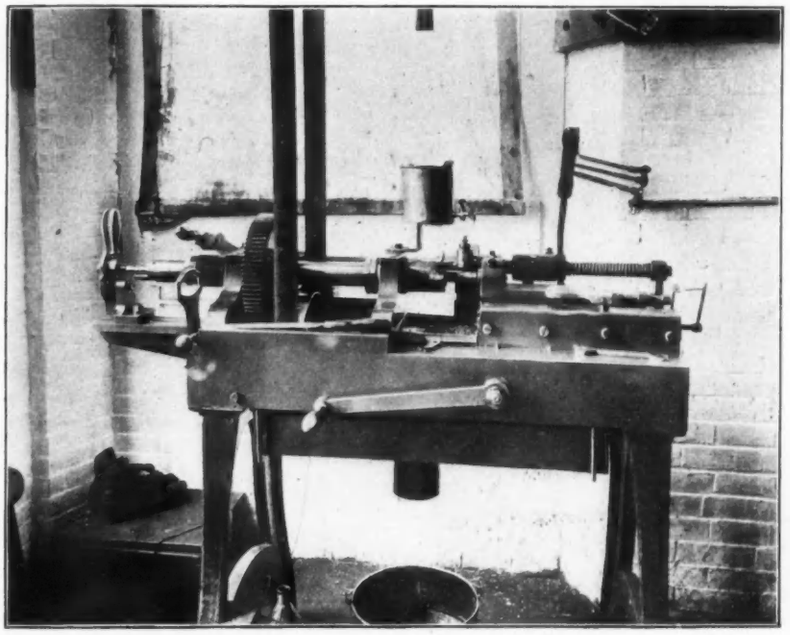


FIG. 8. THREAD-CUTTING MACHINE FOR BARRELS, "WATER SHOP."

the background; in front of them are two old-style profilers, and in the foreground are two milling machines which were built, nobody knows where nor when, but which were probably the nearest approach to universal machines that were obtainable when they were put in, and are of such interest as to make it worth while to show them separately, as is done in Figs. 6 and 7. These machines are in use alongside of some of the latest productions of the Brown & Sharpe Manufacturing Company, one of which, seen in Fig. 6, has had its platen moved during the exposure of the photographer's lens, but which still shows that it was making a spiral cut—which the old machines cannot do. A little study of these machines shows that they possess many features that seem queer now, but nevertheless they are in constant use, making such cuts as are shown in them. The spindle is driven at only one speed, although it seems not unlikely that the original cone pulley has at some period been taken off and replaced by the antique plain pulley with wide belt, to give greater driving power. The spindle

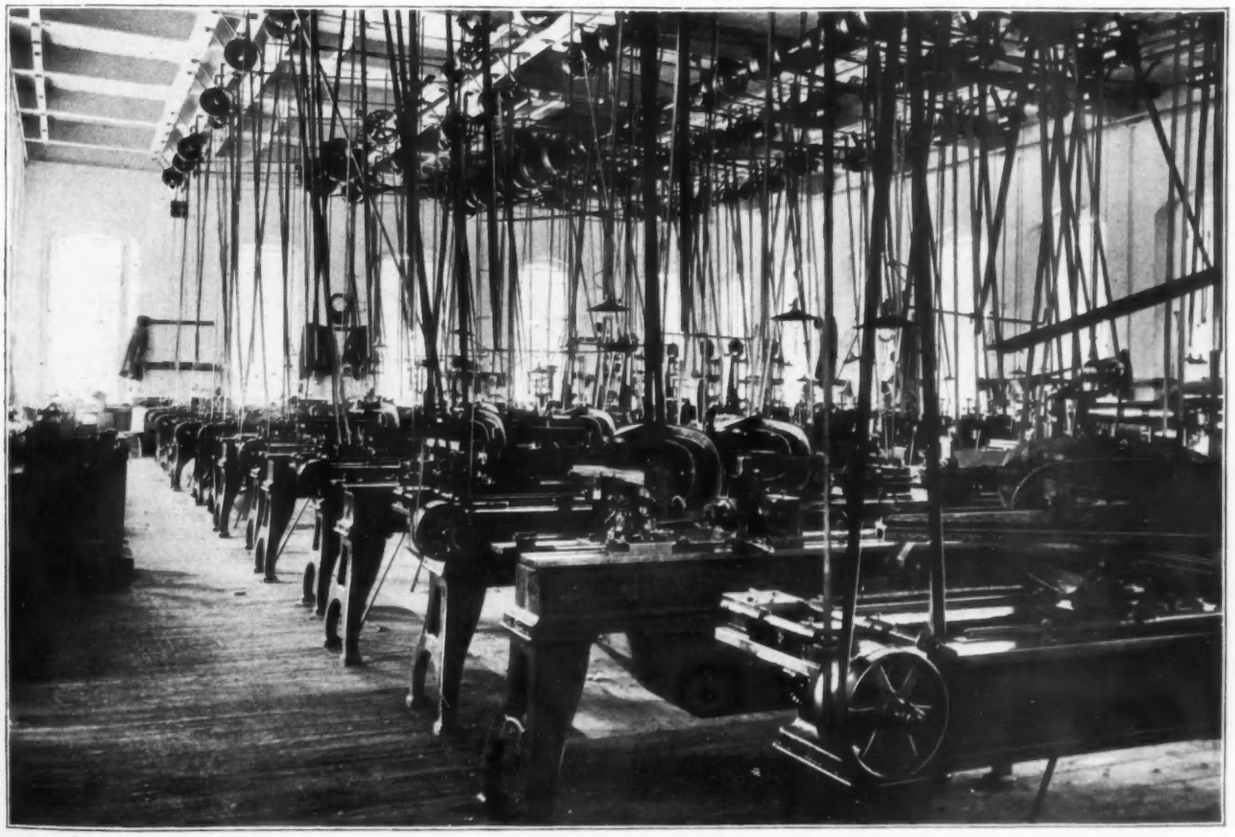


FIG. 9. RIFLING MACHINES, "WATER SHOP," SPRINGFIELD ARMORY.

chiefly as antiquities, or as showing what was the best practice of the day in which they were built. Especially is this the case with the older Water Shops, where many tools are to be seen belonging to a former generation, working alongside of the most modern tools of the same class, and affording in some cases very interesting contrasts. In the Water Shops very many dies are made for drop and trip hammers, and a room is devoted exclusively to the making of these dies. At Fig. 5 is a general view of this room, not showing, however, the work-bench, which extends around the four sides of the room. Three small Sellers planers are in slides through the bearings for the in-and-out feed by means of the lever at the back, while the head moves upon the bed for the longitudinal feed. This movement is automatic, and the roundabout way in which the motion for it is derived may be easily traced from the various photographs. It is thrown in or out by moving

the bevel pinion seen at the left in Figs. 5 and 7, and this does not drive the feed screw direct, but instead a shaft which passes through the machine to the other end, where it is fitted with a hand-wheel, and from this shaft, by means of spur gears, the two parallel feed-screws are driven. There is no knee, but instead a vertical spindle, to the top of which the work is secured, this spindle carrying an index plate and being moved vertically through its bearings for the vertical adjustment; which is made by means of the hand-wheel at the top of the vertical shaft. The automatic feed arrangements do not look as though they were a part of the original design of the machine, and may have been added after the machine had been in use for some time.

Another interesting old machine is shown at Fig. 8. This machine threads all the barrels at the rear where they screw into what is called the receiver, which is really the frame of the gun mechanism. This machine cuts a shallow square thread upon the end of the barrel, making use of the chasing-bar principle. A number of cuts are taken by the tool, which is lowered after each cut by an eccentric arrangement, and there is a stop against which the barrel is placed n the machine, while at the same time a suitable gage indicates the exact place to which the operator must turn the barrel within the hollow spindle before fastening it; so that the thread is thus located precisely with respect to the end of the barrel and the position of the front sight, and will screw into a gage exactly to a mark previously placed upon the barrel with respect to the position of the sight; and, as the receivers are all tapped upon the same principle, barrels and receivers go together properly and with the sights of the gun on top, as, of course, they should be. This point is so closely looked after that it is certain that any barrel made at Springfield will screw into any receiver to a shoulder, and when home its sights will be exactly in their proper positions.

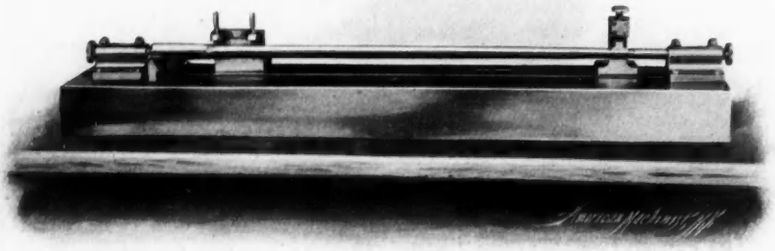


FIG. 10. TESTING DEVICE FOR LOCATION OF SIGHTS ON BARRELS.

Other interesting old tools to be seen in the Water Shops are the barrel polishing machines, which are the same machines that polished the barrels of the muskets used in the civil war.

Near these is a group of the latest barrel drilling machines, made by the Pratt & Whitney Company. There are seventeen of these, and the bore (.3 inch in diameter, 30 inches long) is drilled in an average time of one and a quarter hours, the barrel turning at the rate of 1,200 to 1,250 turns per minute. We thus see that the feed of the drill is about .00033 inch or one third of a thousandth of an inch per rotation. Of course, the most modern form of forced oil circulation devices is used, and the drilling operation is very efficient, notwithstanding the difficulties of

FIG. 11. MILLING SHOP, THIRD FLOOR, "HILL SHOPS."

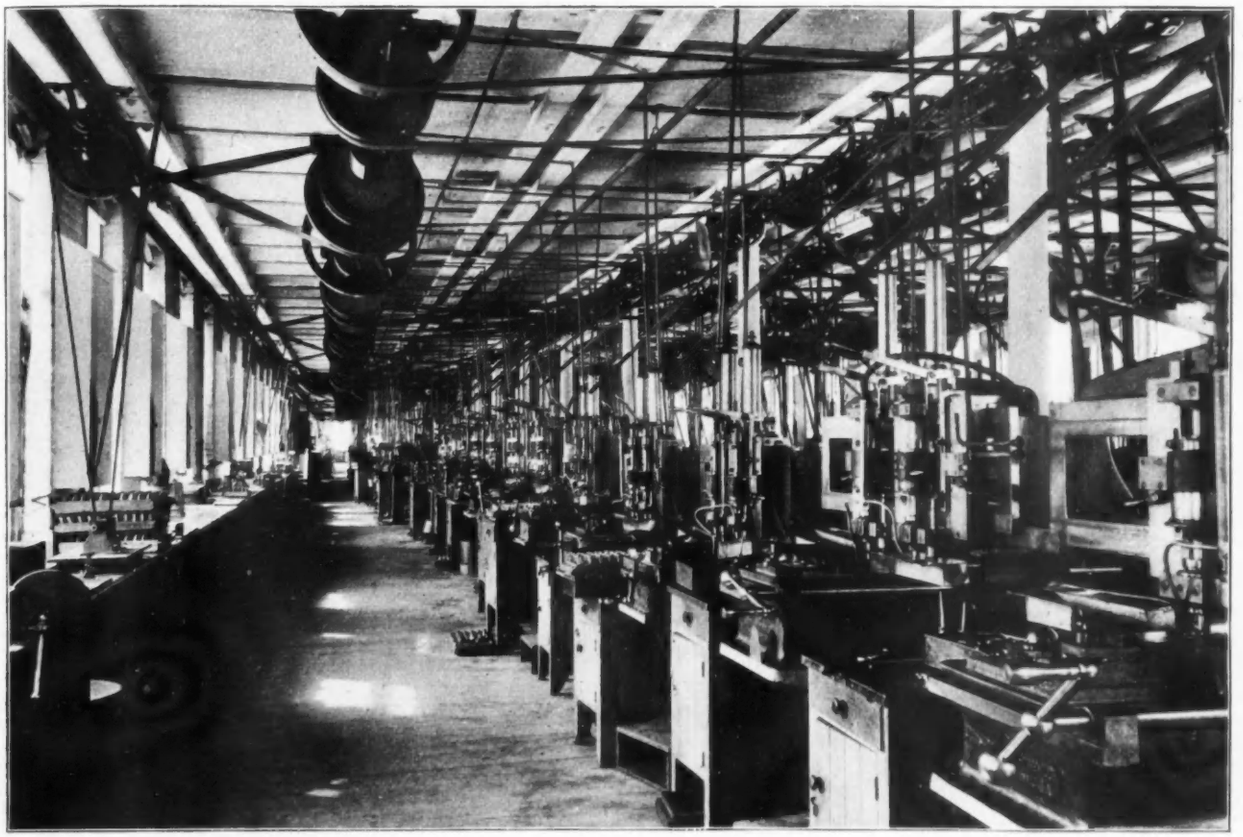


FIG. 12. PROFILING ROOM, EAST END, "HILL SHOPS."

FIG. 13. MILLING SHOP, SECOND FLOOR, "HILL SHOPS."

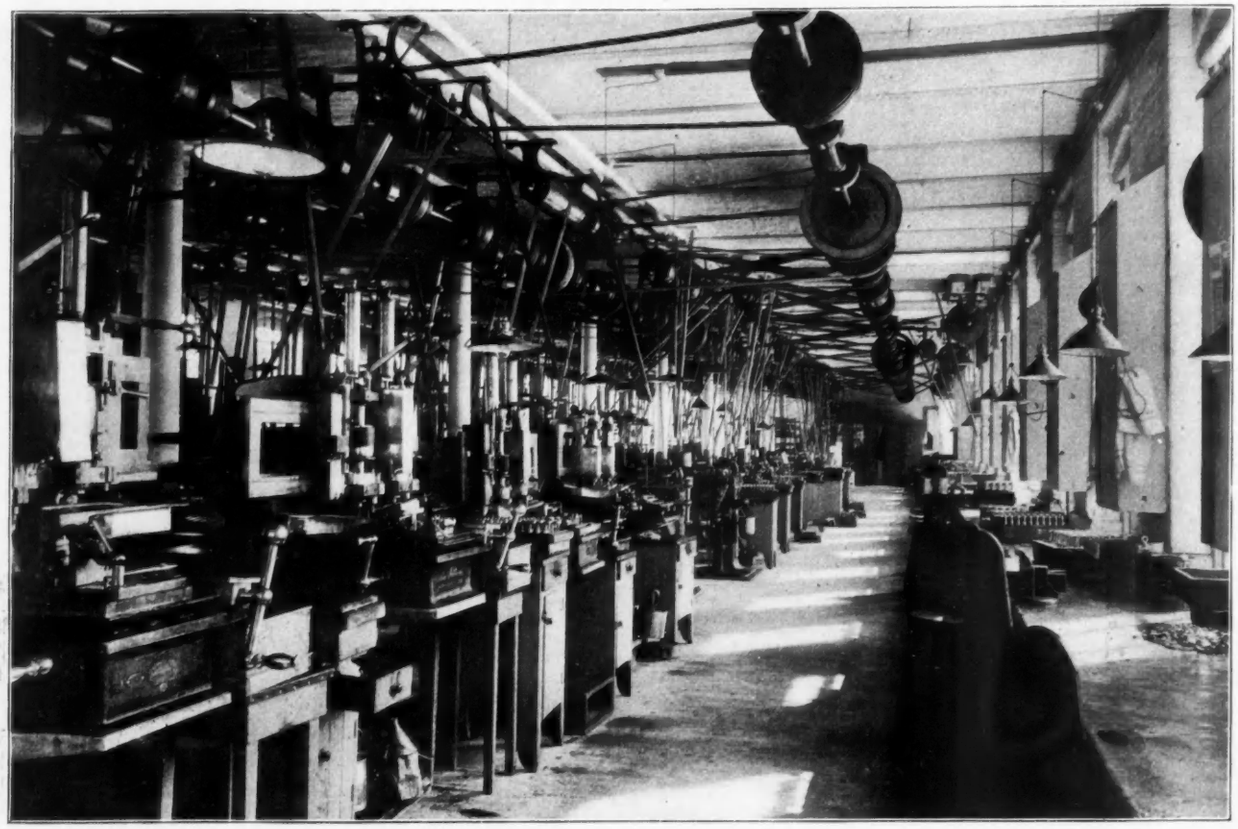


FIG. 14. PROFILERS USED ON BREECH BOLTS.

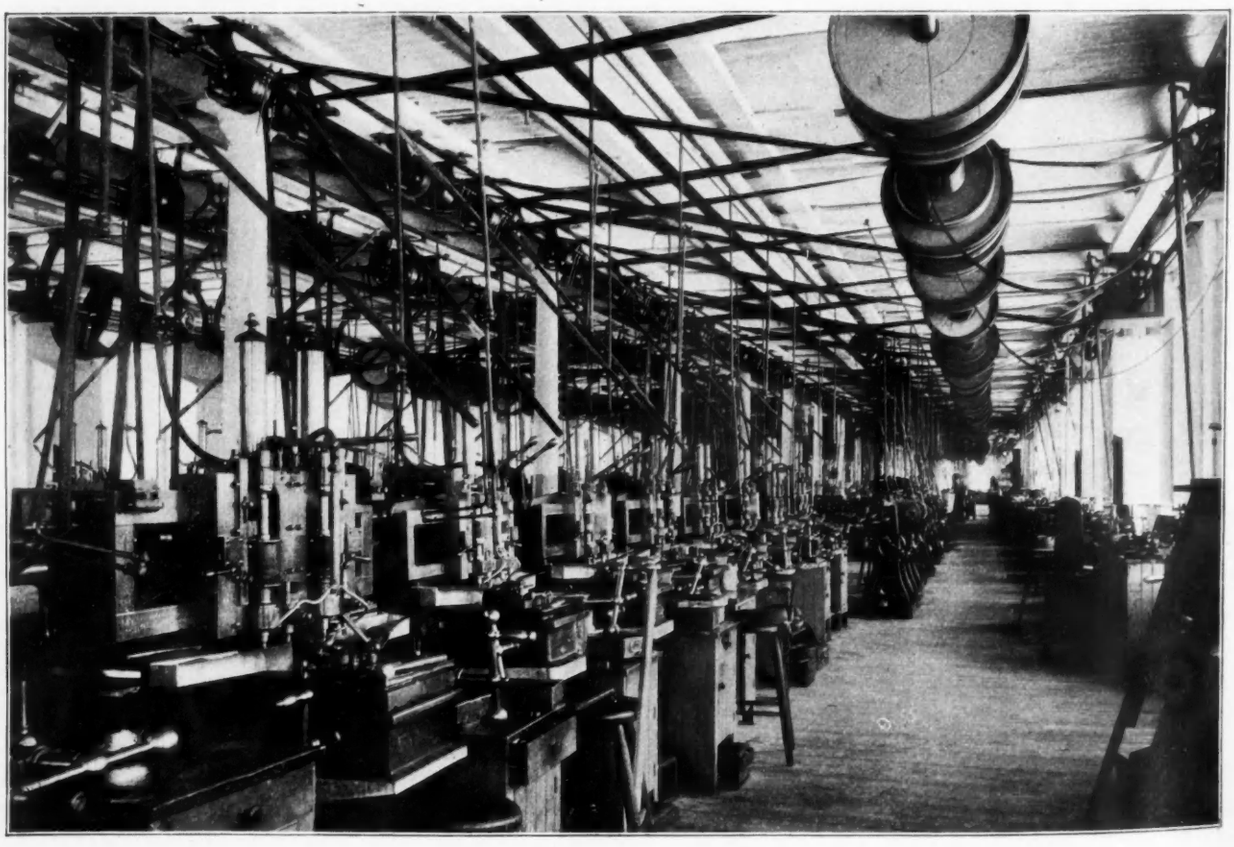


FIG. 15. PROFILING ROOM, WEST END.

small bore and the high steel used in the barrels.

A view of the rifling machines is given at Fig. 9. There are twenty-eight of these, ten of which are of the latest improved form, made by the Pratt & Whitney Company. In the "Krag" gun barrel there are four grooves .004 inch deep and four times as wide as the "land." The rifling has a pitch of one turn in 10 inches. The tools used in this work will be fully described in an article soon to be published, and need not, therefore, be further referred to at this time.

As an example of the methods pursued to secure uniformity and interchangeability, the device Fig. 10 may be cited. This is used for testing the location and size of the two holes that are drilled in the top of the barrel by which the rear sight is secured by means of screws. They are drilled in a jig, which locates the barrel properly with reference to the breech end and the sight and this fixture has a thin blade on the end of the vertical plunger at the right, which enters the slot milled for the front sight, while the two plug gages at the left enter the holes referred to, passing through bushings in the knee. Asked what allowance for variation was made in this gaging, Mr. Ladd replied that there was none whatever, but that the plugs in the ends of the barrel, that in the sight slot and those in the holes fitted "as close as we could make them." Most of our readers know that the Springfield Armory has exerted a commanding influence upon the development of interchangeable manufacture and the practice of to-day is fully up to the highest standard. Besides the gages that are used by the workmen and inspectors there are complete sets of master gages which are used once a month in testing the working gages, there being a man whose duty it is to make this regular monthly inspection and comparison of all gages that are in use.

Figs. 11 to 16, inclusive, give various views in the Hill Shops and show the arrangement and give some idea of the number of profilers, milling machines and automatic screw machines that are used in making parts. On the receiver alone there are 121 distinct operations, all of which have to be made with great care, and so that every receiver shall be practically the exact duplicate of every other one in every respect. In Fig. 11 many of these receivers are to be seen in the boxes, and in Fig. 13 they are also much in evidence, while in Fig. 14 firing bolts are the pieces being worked upon. It will be noticed that in these pictures things look very neat and orderly. Work was not being done at the time the pictures were taken, but when it is going on the appearance of the shops is scarcely different. It is the regular practice to scrub all the floors once a week. In subsequent articles we shall give some further account of things to be seen in the Hill Shops, and finally complete illustrations and description of the Krag-Jorgensen gun.

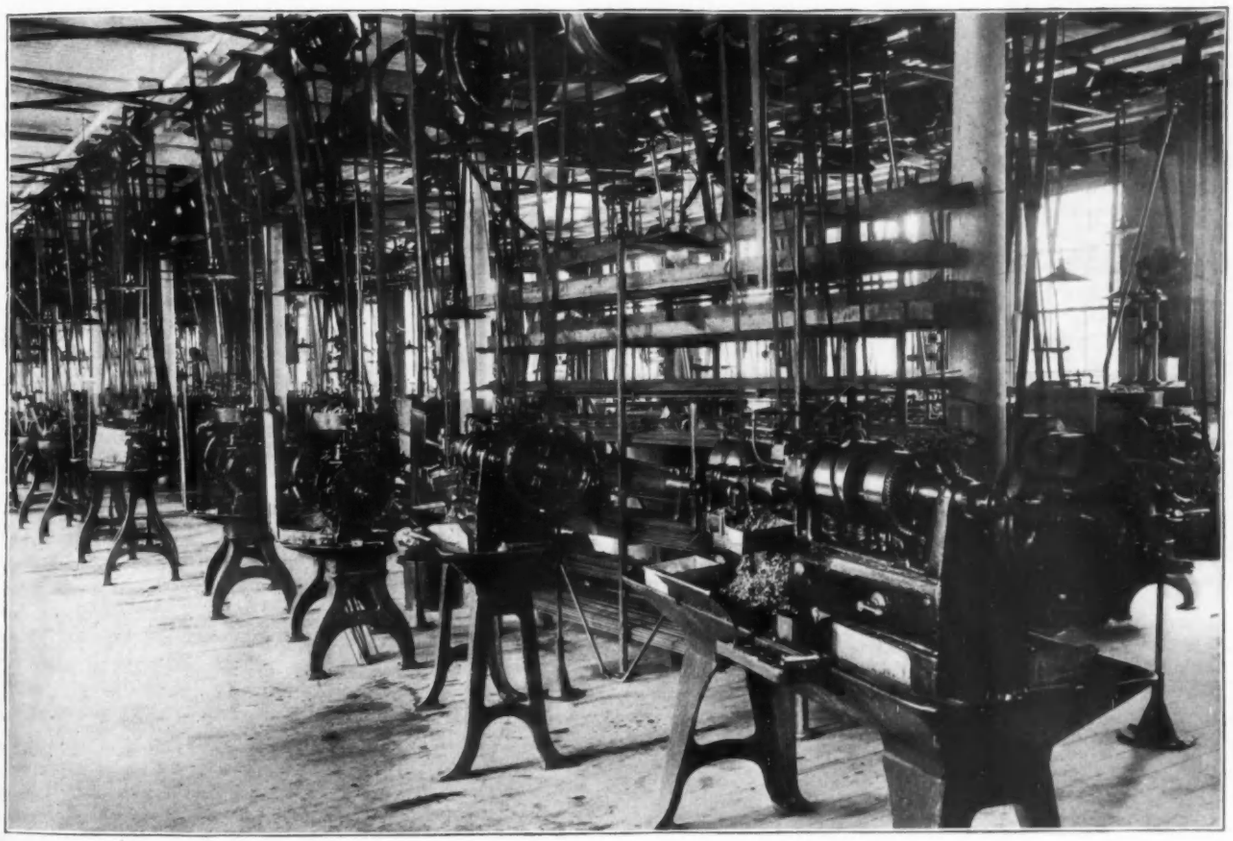


FIG. 16. AUTOMATIC SCREW MACHINES, "HILL SHOPS."

Compass for Drawing Arcs of Large Radius.

BY ULRICH PETERS.

The accompanying illustrated system of link connections, which in some modified shape served in former days of steam engine construction as a substitute for the well-known Watt's parallelogram, is here applied to drawing arcs of any radius—similar to the instrument described by me in the issue of the "American Machinist" of October 12—and like that instrument is independent of the size of the drawing board or the center distance.

Fig. 1 represents a practical construction which was reinvented and designed by Dr. E. Hederich, of Saxony, about seven years ago. The so-called leading rod $A\ B$ has on one end a center point B, with a pivot for the counterguide rods $B\ D$ and $B\ C$, both of the same length, algebraically expressed by c. An adjustable center point V for the guide rod $Q\ V = b$ and a movable fork G for supporting the instrument. The ends of the guide and counterguide rods are pivoted in a frame $C\ P\ D\ Q$ of jointed rods of equal lengths $= d$, forming a parallelo-

gram and carrying at the point P the drawing pen.

Both points V and B are placed on the drawing so that they will cover the center line of the arc, desired to be drawn with a radius $= R$, and the distance $V\ B$ may be called a.

To avoid differential and integral calculus in analyzing the motion of this link system, we will make a conversed supposition and assume the mentioned movement of P in this chain of elementary parts to be always an arc of a circle, and from that condition and relations of lengths a, b, c, d to the radius R, Fig. 2, we shall find, through comparatively simple algebraic and geometrical deductions, the truth of it.

To that end, with a and b as radii, we describe auxiliary circles with V as a common center, Fig. 2, and in the parallelogram $C\ P\ D\ Q$ of any position we draw the diagonals $C\ D$ and $P\ Q$, intersecting in the point N and making intersections at T and U with b and a circles respectively. Drawing the parallels $O\ P = R$ and $V\ T = b$, we introduce the following algebraic expressions for lengths:

$$B\ T = Q\ U = e$$
$$B\ N = n$$
$$N\ D = N\ C = h$$
$$B\ P = r$$
$$Q\ B = u$$

As per figure we can write also $u = r + 2\ n$ and $e = u - 2\ a \cos.\ \alpha$, if α is the angle at B.

Now in the triangles $O\ B\ P$ and $V\ B\ T$, having always the angle $180° - \alpha$ common, $V\ T = b$ is, and $O\ P = R$ should be, constant at every position of P. Granting this to be true for the moment, it follows that

$$R : b = r : e, \text{ or}$$
$$R = \frac{b\ r}{e} \qquad (I)$$

In this expression for R, b has a fixed value, and it only remains to show that $\frac{r}{e}$ has also a fixed value to demonstrate that R is also fixed—that is, that it is the radius of a circle.

For the unknown quantities r and e we have from the triangles $P\ N\ D$ or $P\ N\ C$ the equation

$$(r + n)^2 = d^2 - h^2$$

otherwise: $r\ (r + 2\ n) = d^2 - (h^2 + n^2)$

It was shown above that $r + 2\ n = u$, and from triangles $B\ N\ D$ or $B\ N\ C$ it follows that $h^2 + n^2 = c^2$. Substituting, we have

$$ru = d^2 - c^2 \qquad (1)$$

From the figure $e = u - 2\ a \cos.\ \alpha$, and by multiplying both sides by u we obtain

$$eu = u^2 - 2\ au \cos.\ \alpha \qquad (2)$$

Further, by a known trigonometrical formula, in triangle $Q\ V\ B$

$$b^2 = a^2 + u^2 - 2\ au \cos.\ \alpha \qquad (3)$$

And, substituting in (3) eu for its value as shown in (2), we have

$$b^2 = a^2 + eu$$
$$\text{or, } eu = b^2 - a^2 \qquad (4)$$

Dividing equation (1) by (4), we find:

$$\frac{r}{e} = \frac{d^2 - c^2}{b^2 - a^2}$$

Since a, b, c and d are constants, it follows that $\frac{r}{e}$ is also a constant, and, by reference to formula (I), that R is a constant, or that point P of the linkage describes an arc whose radius is R. Substituting the above value for $\frac{r}{e}$ in formula (I), we obtain

$$R = \frac{b\ (d^2 - c^2)}{b^2 - a^2} \qquad (Ia)$$

for the value of R.

By the construction of Dr. E. Hederich the center distance a of the points is made adjustable and b, c, d have fixed lengths, but it is not excluded that some other combinations of the elementary parts can be made without changing the kinematic motion of the system.

Taking $c = 4\frac{1}{2}$ inches, $d = 11\frac{1}{2}$ inches and $b = 7$ inches, we obtain according to formula (Ia):

$$a = \sqrt{49 - \frac{784}{R}} \qquad (Ib)$$

or

$$a = \sqrt{7^2 - \left(\frac{28}{\sqrt{R}}\right)^2} \qquad (Ic)$$

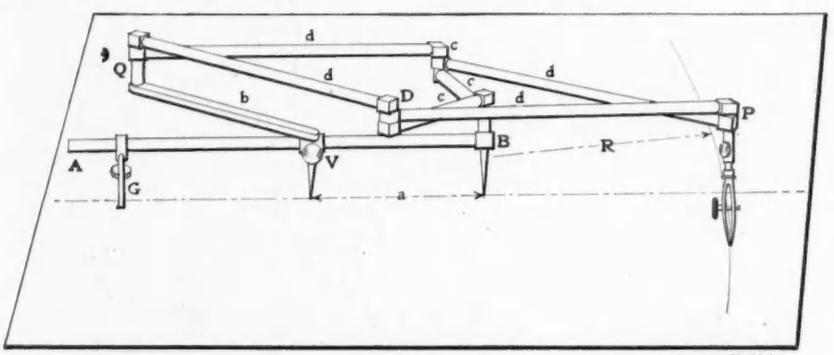


Fig. 1

COMPASS FOR DRAWING ARCS OF LARGE RADIUS.

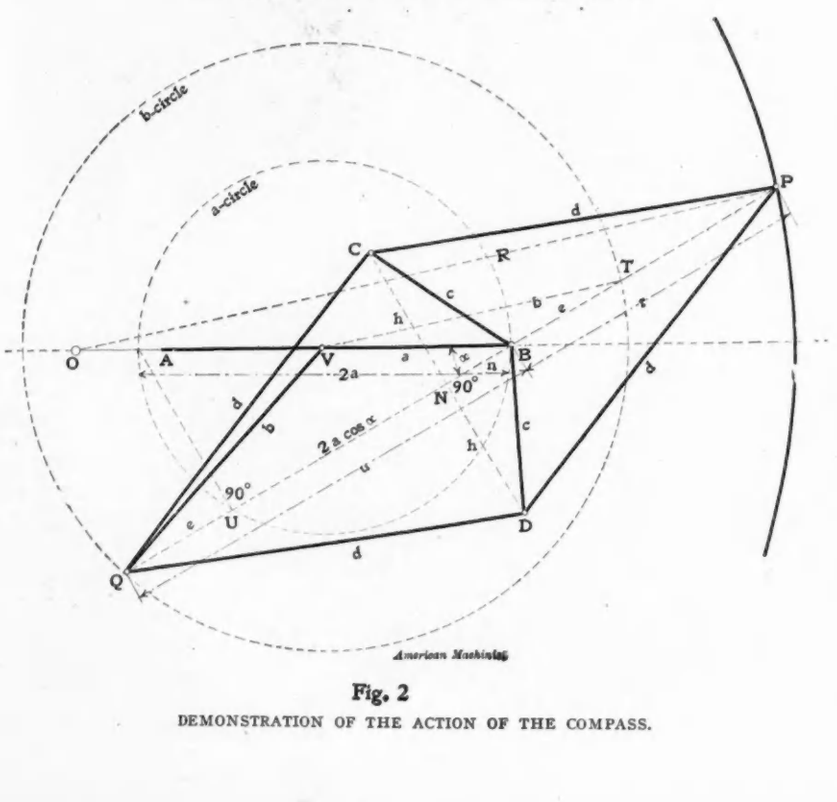


Fig. 2

DEMONSTRATION OF THE ACTION OF THE COMPASS.

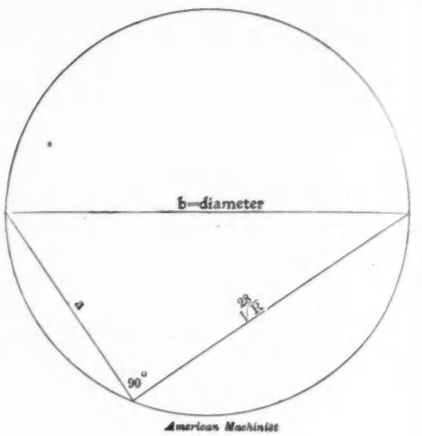


Fig. 3

GRAPHICAL METHOD OF FINDING THE VALUE OF a FOR SETTING THE COMPASS.

For every given R, a can be found by formula (Ib), or by the graphical method Fig. 3 after formula (Ic). For R = infinity; $a = 7 = b$, showing the great range of the instrument.

On account of the necessary, though small, mathematical knowledge for the practical application of this mechanical motion, it has not found much practical use in recent days, while, on the other hand, for example, it gives to the constructor some good solutions in designing universal (arc) planing or profiling machines or attachments and other machines and devices, besides the present application as a compass for drawing arcs of any radius.

Dundas, Ont., Canada.

A Gang Tool Holder for the Planer.

Many of our readers are acquainted with the gang tool holder for use on the planer in finishing broad surfaces, but judging by the infrequency with which we see it in use, not many of them realize its excellent qualities. There is no room for doubt that such tools will do more work and hold their edges much longer than will a single tool on the same work. With a given feed each tool of a gang does but a small part of the work of a single tool under the same feed, and consequently a set of such tools will stand up well under a feed which would soon bring a single tool to grief. Each chip being comparatively light, a planer will carry with ease a feed and a depth of cut which would give it the blind staggers with a single tool, and there is obviously much less tendency to break out the metal at the end of a cut than with a single tool.

One of the difficulties of these tools as usually made is their inflexibility as regards the feed. The tools must be carefully ground to divide up the feed between them, the offset between the first and last tool of a gang must agree with the total feed used, and, when set, the gang is adapted to no other feed than that for which it is set.

By the courtesy of the Nordberg Manufacturing Company, of Milwaukee, Wis., we present herewith a design for such a tool, which is in daily use in those works, and which overcomes these difficulties. The side view, Fig. 2, and inverted plan, Fig. 3, show the tools to be inserted in a block a, which is attached to the shank b for the planer clapper by a swivel connection. The shank is flared at the bottom, while the tool block is undercut and fitted with a clamping gib c. The flared end of the shank and the undercut of the tool block and gib are turned as indicated in the plan view of the block, Fig. 1. With this arrangement it is obvious that after loosening the binding bolt of the gib, the tool block may be swiveled on the bar and the advance between the first and last tool of the gang may be adjusted to make it agree with the desired feed, and the adjustment may be changed from one feed to another in a very few seconds. As a preliminary, the tools are, of course, ground alike, while the setting for uniform depth is simply a matter of allowing them to stand on a flat surface while the shank is in place in the planer.

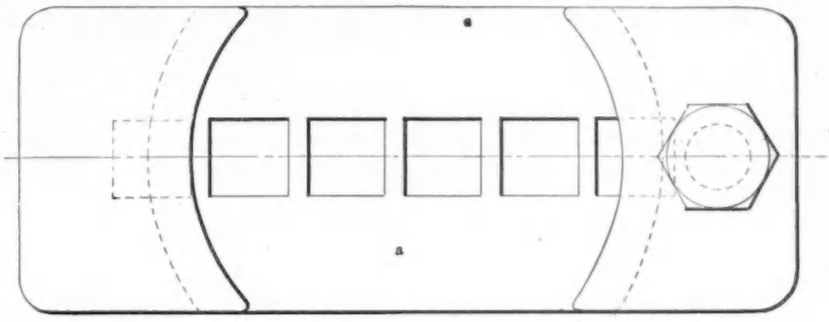


Fig. 1

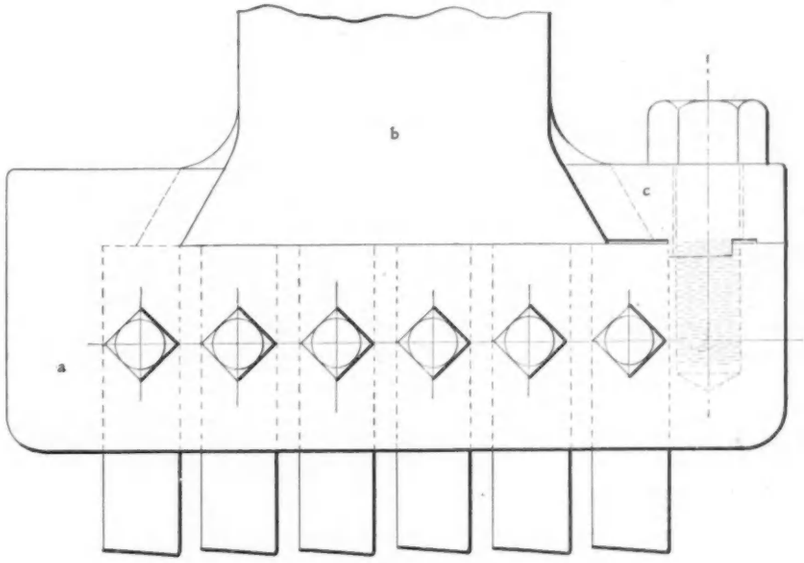


Fig. 2

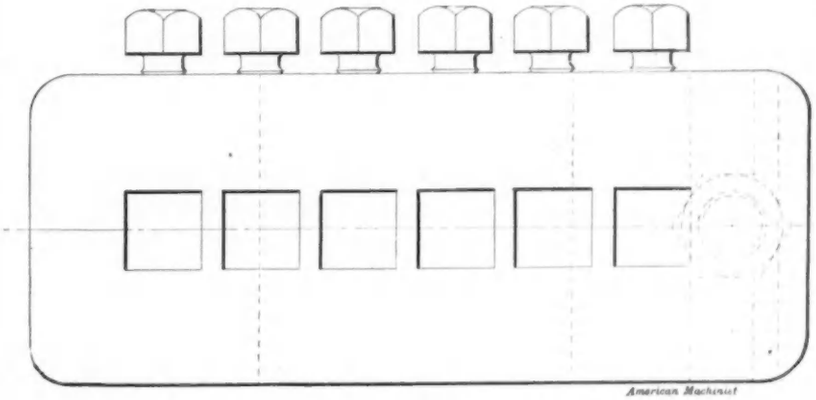


Fig. 3

A GANG PLANER TOOL.

The swivel adjustment alters the clearance angle of the tools, of course, but to too slight a degree to be of any consequence. In the gang shown the distance between the cutting edges of the first and last tool is 4½ inches, and it is clear that an adjustment of from, say, ¼ to ½ inch total advance between them would have but a trifling influence on the clearance.

Drill Presses in Lots of Fifty.

We hear much in these days of machine tools being "put through the shops" in large lots, and those who work in or who have occasional opportunities of seeing such lots of tools "going through" know what the shop looks like and what an impressive sight the tools thus manufactured sometimes make. Building drill presses in lots of fifty, for instance, is not such a novelty as it was a few years ago, but

FIFTY 32-INCH DRILL PRESSES ON THE ERECTING FLOOR OF THE HAMILTON MACHINE TOOL COMPANY.

those who have never seen that number of machines all in a row and in course of erection at the same time, do not so clearly grasp the meaning of it and the effect it produces upon the appearance of a shop. The accompanying photograph will help to give a clearer idea of this. It shows fifty 32-inch drill presses on the erecting floor in the shop of the Hamilton Machine Tool Company, of Hamilton, Ohio. The one nearest the observer has only the post or column in place on the base plate, while the others are in various degrees of more advanced progress; those toward the further end of the row having the hand wheels in place, and a cone shaft with attached parts is seen suspended from the overhead hand traveler.

The American Machine Tool Trade.

BY W. H. BOOTH.

The growth of this trade in Europe recalls to mind a phophecy of some years ago, that the large trade with foreign countries that was being carried on by the Lancashire makers of textile machinery must inevitably result in checking the export of manufactured cotton goods to the countries which were purchasers of spinning and weaving machinery. This prophecy has been fulfilled. English machinery has gone to India, Japan, Spain, Italy and other countries, and an enormous native industry has sprung up in especially the first two countries named.

Owing to certain influences that, in my opinion, have been harmful, in the greatest measure, to those they were designed, ostensibly, to benefit, the engineering workshops of this country have, many of them, remained in a stationary, and therefore, relatively to the rest of the world, in a retrograde condition. I am aware that the subject is one of considerable controversial acerbity, and I merely record the above as my opinion, based on reading, conversation and experience of the more modern tactics of trades unions, which differ so greatly and, for trades unionists themselves, so very unfortunately from the tactics of those reasonable men, many of whom I knew years ago and was glad to be able to number among my friends. Capital is always so very apt to be unfair and aggressive that I look upon it as a misfortune when labor puts itself deliberately outside the pale of reason.

Only those who are acquainted with facts know what a paralysis was taking hold of the engineering trade of this country as a result of unreasonable methods. Output was reduced from machinery that had fallen out of date. Old firms had retired and new ones did not fill their places. Work went on sufficiently to fill the orders of a slack period, and when the revival came, and, curiously and oppositely to the usual course, it came here before it arrived in America, it found a complete inability to cope with orders. The immediate result of this was that orders went abroad in large numbers and everyone here is overrun with work for engines and machinery.

The comparative settlement of the trade dispute has given a new impetus to improved methods, and men who were foremost in opposing improved methods and tools have even been found abusing the English shops for lacking such things.

This recognition of the impossibility of any longer checking the march of progress has had the effect of setting the shop owners free to purchase and work tools to best advantage, and it is no exaggeration to say that at this moment all our English works might double their capacity and yet would not, as orders now are, overtake their order ledger this side of midsummer. Obviously, this implies a big demand for tools, and though for a time American engines and other machinery will continue to be purchased, this branch of business is pretty certain to be overshadowed and probably, in time, extinguished by the other branch of American trade in machine tools. The American tool trade has steadily progressed for some time, and is likely to grow, for there will be a large demand that cannot be filled on this side, though ultimately the competition will become much keener. But it is just in this large importation of tools that American trade in one branch will tend to restrict other branches, as the Lancashire cotton machinery has restricted certain branches of the cotton export trade.

As Mr. Halsey has pointed out, the pre-eminent position of the American tool trade has come about through men who

did not, in most cases, see much of the inside of the technical colleges, but did learn their business in a manner that is hardly now possible, and the future of the trade presents various difficulties which, so far, no one seems to have tackled better than Mr. Halsey. The old system of learning a trade has probably gone forever, and the evolution of a sufficiently satisfactory new system can only be effected by trial and error. In the meantime, Americans should certainly push business over here, as there is an undoubted desire to give all possible outside work to Americans, rather than to foreigners. We don't object to people holding bad opinions of us, but when they allow their opinions to descend to filthy abuse of everything English, as is now fashionable in Europe, we may be excused for preferring to deal with our own kindred.

London.

Pattern Making—Using Loose Pieces Instead of a Core.

BY JOHN M. RICHARDSON.

The pattern shown in Fig. 1 is made entirely without core print or core box, and it shows how loose pieces can sometimes be brought into play to advantage. It represents the bed piece for a certain small machine for special work, its total length being only 14¾ inches, and it was not intended for a permanent, or standard, pattern.

Usually bevel guides like those shown would be cored out; but in this case the inside of the pattern was coped, and if a core print had been added to the outside it would have had to come even with the edge that was coped, and so it would have been an awkward core box to make, fitting around, as it would, the side of the piece. Besides, when one part of a flat surface is made by the mold and the rest is formed by a core the casting hardly ever has the two surfaces exactly to match, and even when they do come together nicely, the part made by the core has a different appearance. Notwithstanding all this, it would doubtless have been easier for the molder if a core had been used in the present instance, but for one casting it would take less time for him to remove the loose pieces than it would the pattern maker to make a core box.

Fig. 1 shows three views of the pattern, with the various loose pieces wired in position. The round bosses *A B C G H* and the ears *D E* and *F* need no description, as they are simply picked back into a generous space after the pattern is removed.

The loose parts *I J K L* of the guides are started back in the direction of the parallel dotted lines and arrows in the end view, and here the space becomes more limited, so it might be well to dwell for a few minutes on the subject of loose pieces in narrow quarters.

Take first the simplest possible example, shown in Fig. 3. The two triangular pieces inside the lines *C D* on each side are supposed to be wired to the main part of the pattern, and when it is withdrawn these pieces are left behind. Referring again to the figure, it may look as though there was not room enough to extract the pieces, but as long as the distance *m* does not exceed the length *n*, the part can be easily removed, for the instant it is started all is free, and it can be drawn up through the opening *n* without difficulty.

In doubtful cases the simplest plan is to make a line on the drawing, as at *C D*, so as to divide the loose piece from the main pattern, and then place over it a piece of thin paper and trace the outline of this part. Next cut the paper to the lines, and see if, when it is placed over the drawing again, it can be moved between the lines which would represent the sides of the mold.

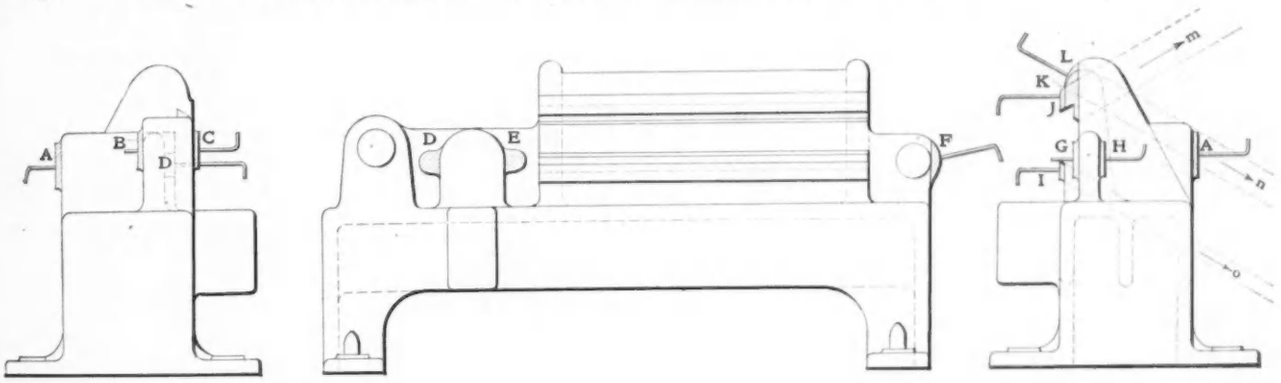


Fig. 1

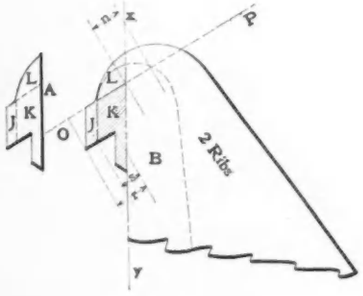


Fig. 2

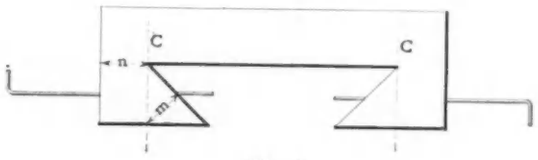


Fig. 3

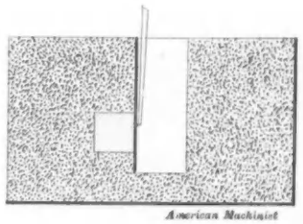


Fig. 4

PATTERNS WITH LOOSE PIECES INSTEAD OF CORES.

When a loose piece is drawn from a mold, as in Fig. 4, where it must come steadily in one direction until it is entirely free and with no chance for rolling or tipping it, we must remember that the pointed wire the molder inserts in the piece is taking up part of the cavity through which the piece must come, so that allowance must be made for this wire also.

Now, to return to the original subject and examine the pattern we started with, we find the quarters rather close in which to remove the upper part of the guide, shown better in Fig. 2. Everything to the left of the line *x y* must be loose and come out through the cavity made by the solid part of pattern *B*, with its two ribs. Let us make a paper templet *A*, as before described. It is evident at the outset that the part *A* cannot be withdrawn in one piece, so we will cut off the part *L* and note the result. The piece must be slid back in the direction *O P* a distance equal

to *r;* but as the length *r* is greater than *n*, it will strike, so we will next cut off the part *J*. The remaining piece *K* must now slide back in the same direction as before a distance equal to *s*, but as this is less than *n* all is now clear, and *K* can be withdrawn easily, and then *L* and *J*. The loose piece *I* on the lower part of the guide in Fig. 1 comes readily, as there is ample room for it.

A Drilling Fixture.

BY D. E. MAC CARTHY.

The accompanying drawing shows a six bearing spider casting and a jig for drilling the cap holes at *a b, c d,* etc.

The fixture is so simple in design as to almost demand an apology from the writer for presenting it to the multitude of intelligent readers of the "American Machinist." However, it embodies one or two very important points in the manufacture of duplicate parts, viz.: low-cost tool-making and speedy handling of the work to be drilled.

The fixture consists mainly of but four pieces—the plain angle-iron *A*, the stud *B*, the bushing plate *C* and the steel top-piece *D*.

The piece *C* is fitted to slide free in the top of angle-iron and beneath the steel-piece *D*, which also serves for carrying the knurled thumb-screw *E*.

The casting to be drilled is first bored through the center, hub faced and six cap surfaces milled true by index, when it is ready to slip on over the stud *B* on the jig. The bushing plate is located from the center stud in such a position as to slide close over the casting, stopping accurately by its shoulder against the back of angle-iron, and held securely by a turn of the thumb-screw *E*.

Two spindles of the multiple-spindle drilling machine are set in the bushing holes, then the fixture is permanently secured to the table by bolts. After drilling the first two holes the bushing plate is slipped back, and the casting turned for the next drilling. The bushing plate acting each time as an index for itself, it will be noted that the same fixture may be used for any number of bearing spider castings of the same diameters.

A Pioneer College Shop.

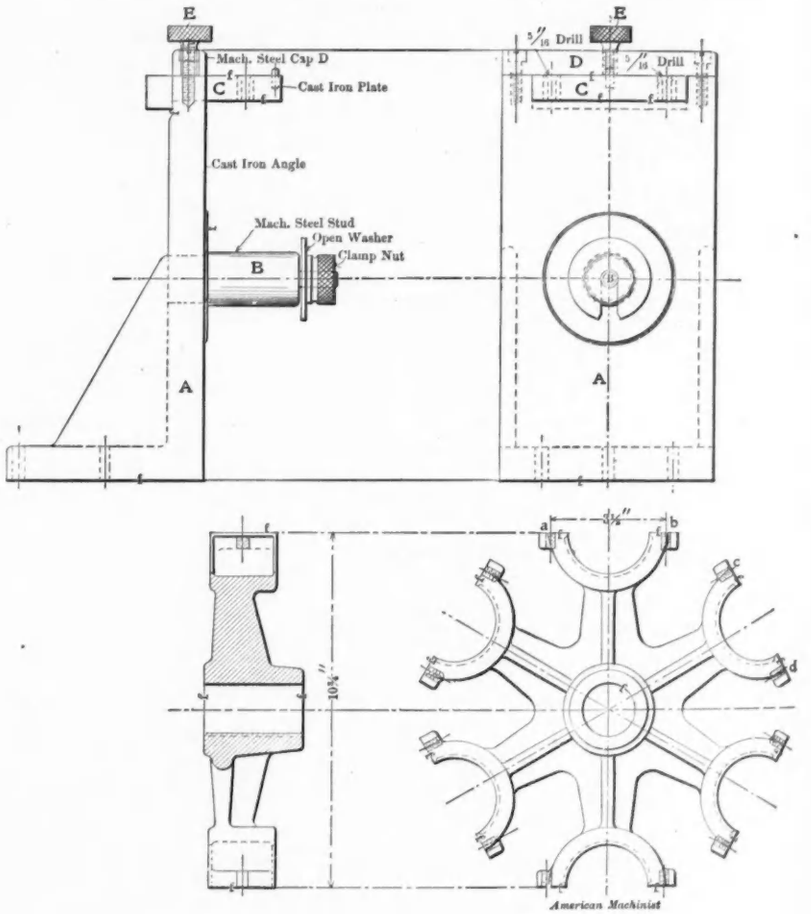
The State University of Illinois sends us a late number of its bulletin, in which it makes a strong claim of priority in college shop instruction. In its own words:

"The University of Illinois was opened for students in 1868, and from the very beginning has devoted a large share of its resources to the development of its College of Engineering. In 1870 the professor of mechanical engineering and a few students working with a small portable engine in a shed, designed and built a steam engine, and proved their ability to use the better equipment which was soon forthcoming. Thus was opened the first distinctively educational shop in America, though the credit for this is frequently claimed for another institution."

The College of Engineering now has a force of thirty-three instructors, who give all of their time to engineering subjects. The curriculum embraces several technical courses, including electrical, mechanical and railway mechanical engineering and architecture. The mechanical shops afford opportunities for practice in wood-working, forging, foundry and shop work. Pattern work occupies a leading place in the wood shop. Blueprints are furnished to the student for all his work. No attempt is made to manufacture any article for sale.

Additions to the equipment, however, are continually being made. Four steam engines of different types have been made, of 20, 30, 35 and 45 horse-power. At present a special compound steam engine of 60 horse-power is being built, also a high-pressure air compressor. Several special machine tools, wood lathes and a large number of other tools are usually in progress of construction.

The university publishes a book of views showing its buildings and laboratories.



A DRILL JIG.

Letters from Practical Men

Numbering Patterns.

Editor American Machinist:

Recent articles on drafting-room methods and pattern numbering, together with the very cordial invitation extended in your issue of February 8, form an excuse for calling attention to a system which I have not seen mentioned before, and which possesses some very meritorious features.

It is in partial use by an establishment where a good many repair orders are received which demand rapid and accurate work, and the information is usually contained in the bare pattern number. It elaborates to some extent the system of giving each type of machine a number or letter, but the pattern number is the admirable point in doing away with one operation of a great many pattern-number systems.

As stated above, each type of machine has a number, and a cabinet of drawers, each to hold approximately 100 tracings, was built in the vault and a duplicate built in the drafting room for active service. The drawings in each drawer are numbered consecutively, beginning in hundreds. That is, the first drawing in No. 1 drawer is 101, in No. 2 drawer 201, in No. 40 drawer 4001. Then the patterns

are numbered to each sheet, thus: 101A, 101B, and so on; 4001A, 4001B, and so on; the number on the pattern showing at once where to find the drawing.

When a pattern is altered, however slight the alteration, it is given a new number and "altered from pattern No. —" added in a proper column on the sheet bill of material. Minor changes, as hub length and bore of gear, can be noted on the drawing this way without requiring a new drawing, but giving a perfect identification.

To complete this system, two card indexes are desirable, though a list of parts may be substituted for one. Using two, one corresponds to the drawer classification, with a card for each piece in the machine, properly marked pattern number, name, weight, principal dimensions, name of machine, date put into use, date discarded, pattern number of substitute, number of pattern altered from, number required for one machine, and such other information as may be considered necessary. The second classifies them as bearings, wheels, caps, and so on, for the benefit of the drafting room. The cards would be like those of the first index, special attention being paid to the dimensions, as they are what the draftsman is looking for.

The pattern storage should be on the same general lines as the drawer arrangement. Any loose pieces used in making an alteration should be kept in their proper section, but the original should always be returned to the section to which it first belonged.

I have assumed, as a result of experience, changes in patterns for use on several machines, but if new patterns are always made, the system is correspondingly simplified.

I think this system will fill Mr. Blount's requirements if fully carried out, and it can be done with a minimum of work and care, giving such refreshing results over the majority of half-baked systems as to fully repay the effort of making a change.

Harvey, Ill. C. H.

[The name of the author of the above has been mislaid. Will he kindly send it? —Ed.]

Calculations for a Crane Girder.

Editor American Machinist:

Referring to Mr. Williams' article in the issue of February 8 on "Calculations for a Crane Girder," I fail to understand why the bottom flange is figured out with some omissions. If rivet holes are taken into consideration, why not in the top flange also? I often figure plate girders for buildings, and take into consideration rivet holes (13-16 inch) in top and bottom flanges. CONSTANT READER.

As we prefer to have criticisms upon an author's article answered directly by the author, we sent the above to Mr. Williams, who replies as follows:

Editor American Machinist:

In regard to "Constant Reader's" criticism of my article on "Calculations for a Crane Girder," the rivet holes were deducted only in the tension member—in this case the bottom flange. In the compression member the rivets take the place of the metal punched out, and the gross section is figured. There is no necessity of deducting rivet holes in both chords of a girder unless they are both in tension.

The following from a standard bridge specification may be new to "Constant Reader:"

"Net sections must be used in all cases in calculating tension members, and in deducting rivet holes they must be taken ⅛ inch larger than the size of the rivets."

A. D. WILLIAMS.

The Effect of Size of Turned Forming Tools—Tools for Making a Nut on the Automatic.

Editor American Machinist:

Notwithstanding remarks to the contrary in the "American Machinist" of February 8, I consider that the diameter of circular tools has much to do with their standing-up qualities.

In Fig. 1 I show two circular tools of 1½ and 2 inches diameter, respectively, both cut out ¼ inch below center, as they would be if intended to operate on the front side of the machine or at the back side with the work running backward. Although shown in this position the principle involved is of course the same as though the tools were placed the other side up, the tool-post being bored out above the center of work spindle, instead of below, as in the case referred to.

Referring to Fig. 1, it is easy to see that the cutting edge of the larger tool would have much greater endurance than that of the smaller, the rake or clearance of the latter being excessive. This difference of rake in circular cutters must of course increase with the difference in diameter of the cutters, provided the cutting edges are located at the same distance from center. The case is similar to that in Fig. 2, where are shown side by side two straight cutting-off tools, the clearance of one ground as at *E* and the other as at *F*. The angle of clearance of *E* is practically the same as that of the larger circular tool in Fig. 1, while that of *F* coincides with that of the smaller tool and shows much less durability than the tool ground as at *E*.

It has been my practice in making tools for a certain size machine to keep them as closely to one diameter as possible. In the larger machines cutting out the tool 3-16 inch from center, and of course boring the tool-post a corresponding amount above or below the center, according to which side up the tool is to be operated. For the smaller machines I have made the tools of less diameter, cutting them out ⅛ inch from center and boring the post to correspond. In Fig. 3 line *A B* represents center of work, *C D* center of large cutter, showing the same cut 3-16 inch below center, while *C' D'* represents center of small cutter and shows the same cut ⅛ inch below center. The clearance of both cutters is practically identical.

I once saw an automatic equipped for making ½-inch nuts from the hexagon

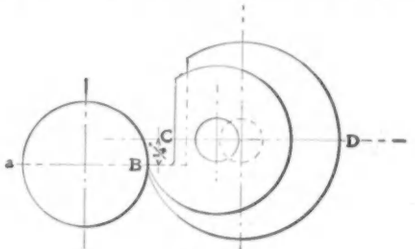


Fig. 1

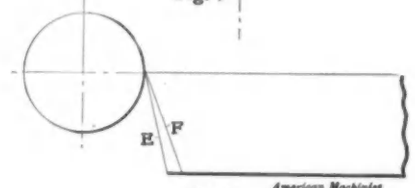


Fig. 2

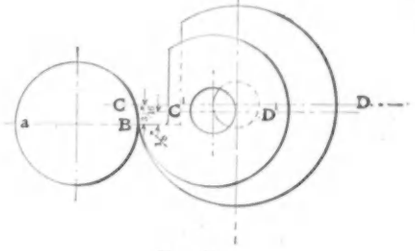
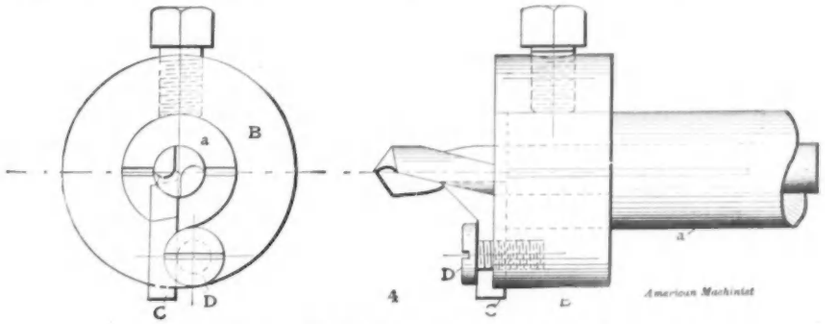


Fig. 3

EFFECT OF DIAMETER ON TURNED FORMING TOOLS.



TOOL FOR DRILLING AND CHAMFERING A NUT IN THE AUTOMATIC.

bar, drilling, tapping, chamfering both inside and outside, and finishing complete in the one operation, and think the tools may be of interest to some engaged in screw-machine work.

The turret had four holes, and Fig. 4 represents the first tool; a regular drill-holder carrying the drill, and the tool *C* held by the screw *D*, the tool fitting nicely

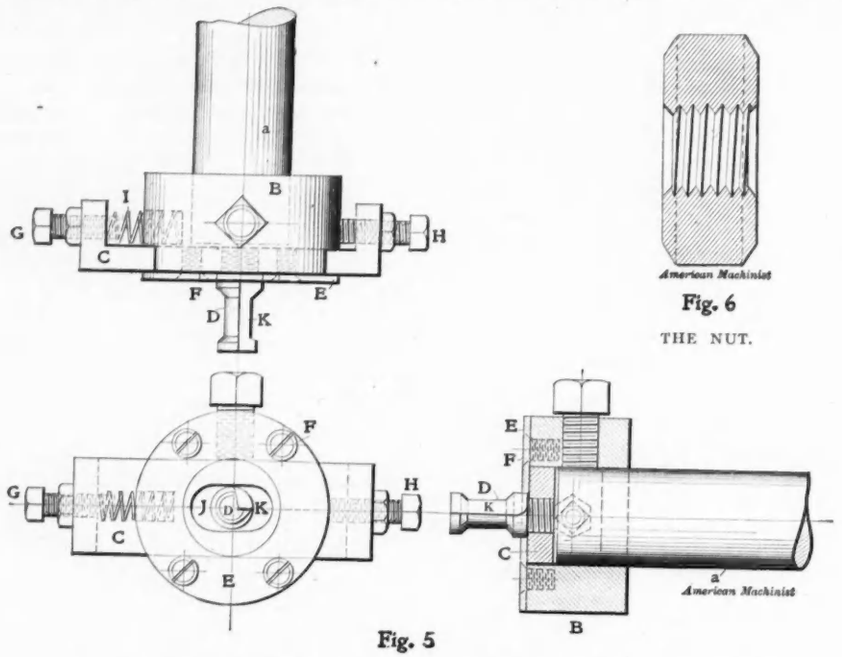


Fig. 5

TOOL FOR CHAMFERING THE INSIDE CORNER OF A NUT IN THE AUTOMATIC.

in a slot in the face of the clamp collar *B*. The inner end of the tool *C* is set into the groove of the drill and chamfers the front end of the hole. The outside of the nut is chamfered both back and front like a regular check-nut, and a circular tool on the front of the cross-slide is forming the outside of the nut, facing the front and necking down in back for the cutting-off tool, simultaneously with the drilling operation. Fig. 5 shows the tool for chamfering the back end of the hole, and consists of a blank drill-holder *A*, fitting the turret, and the collar *B* having a slot planed across its face to admit the slide *C*. The thin plate *E* is fastened to the collar by the four screws *F* to keep the slide in place.

The slide is shown in its central position and carries a small circular tool *D* for recessing or chamfering the back end of the hole. The plate *E* is cut out at *J* to clear the tool. The tool is of a size to just enter the hole without cutting, and is kept in a central position, except when performing its cutting operation, by means of the check *H* and the spiral spring *I*.

The cutting-off tool-post on the back side of the cross-slide carries a small plate at the right hight to engage with the screw G. The turret slide brings the tool quickly into position and stops while the cross-slide feeds forward, operating the slide *C* and forcing the cutting edge *K* of the tool into its cut. The closs-slide moving backward allows the spiral spring to bring the tool into its central position again when it is withdrawn from the hole by the turret slide.

Two taps were used on the job, and were held in ordinary revolving die-holders. The first was about 1-32 inch under size, and at the front end was tapered in the bottom of the thread as well as at the top. The second, or finishing tap, had very little chamfer, it having to cut a full thread to the bottom of the hole. The forming tool necking down on the outside, and the recessing or chamfering tool removing considerable stock from the inside, very little was left for the cutting-off tool to do to complete the job. The hole was drilled just deep enough to leave a small center in end of bar after the nut was cut off.

Considerable trouble was experienced at first with chips getting between the end of taps and bottom of the hole. The difficulty was overcome by connecting a small piece of pipe with the regular oil pipe and bending the end so that it would direct the oil into the hole and force all chips out.

Fig. 6 is a section through the center of the finished nut, showing inside and outside chamfer. S. F. ARTHUR.

Fig. 6

THE NUT.

A Simple Coupling for Motors and Pulleys.

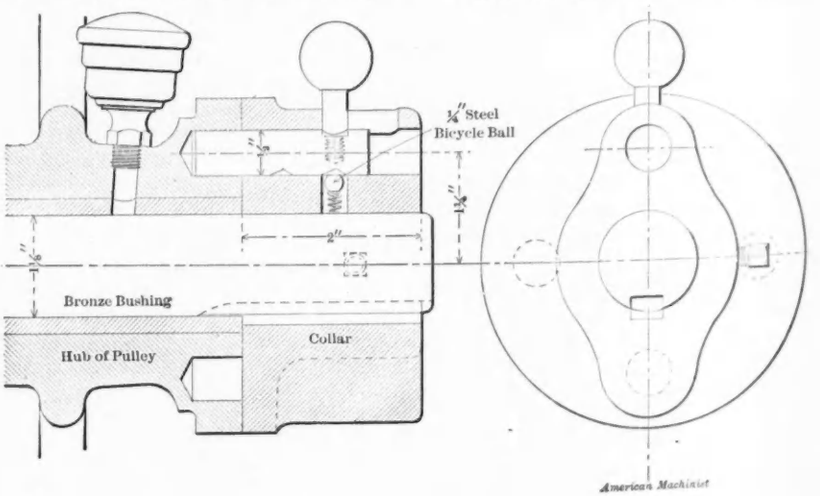
Editor American Machinist:

A little time ago we had occasion to furnish a three horse-power electric motor for driving a circular saw and a buzz planer. The machines were to be belted directly to driving pulleys on each end of the motor shaft, and connections were to be such that either machine could be run independently. Various types of friction and jaw clutches were considered, but did not meet our requirements. As the motor was to run at about 1,000 revolutions per minute, it was thought advisable to adopt a mechanism that could be operated only when at rest. The "latch" coupling shown in the enclosed sketch was finally evolved, and was found to work so well that several of similar type have since been used.

The action is simple but certain. Each pulley, having a bronze bushing, runs loose on the shaft, but is prevented from moving endwise by the latch collar. This is secured on the end of the shaft by a key and a set-screw. The latch is a piece of ½-inch round steel sliding in this collar and engaging in any one of four holes drilled in the enlarged end of the pulley hub. To prevent the latch from moving accidentally there is provided a bicycle ball, pressed outward by a spring, and entering either of two slight countersinks in the latch. The ball and spring are placed in a little well drilled in the body of the collar. This lock was found to be amply sufficient under all conditions.

The knob by which the latch is slid in or out being placed on the side, there is little liability of its catching the clothing.

Of course more than four holes could be



COUPLING FOR MOTOR AND PULLEY.

drilled in the pulley hub if desired, but no hardship was experienced in turning the armature shaft through less than a quarter of a rotation to cause the clutch to engage. This device may be old, but I do not remember having seen it before.

EDWIN RUST DOUGLAS.

East Orange, N. J.

Personal.

J. W. Duntley, president of the Chicago Pneumatic Tool Company, has sailed for Europe in the interest of his company, where he will remain for about two months.

Charles W. Barnaby, formerly superintendent with the Phœnix Iron Works Company, of Meadville, Pa., has signed with a Russian gold mining company, to superintend the erection, equipment and operation of a large machine shop, foundry, etc., near Lake Baikal, the present terminus of the Siberian Railroad.

Obituary.

Nathaniel B. Boyd, assistant melter and refiner at the United States Mint, Philadelphia, died suddenly in that institution March 15, sixty-eight years old. Mr. Boyd had been employed in the mint thirty-one years.

Prof. James Henry Smart, president of Purdue University, died at Lafayette, Ind., February 23, fifty-five years old. Prof. Smart was elected president of Purdue in 1883, when it was little more than an academy or high school, with a small manual training department, the institution being also in debt and the victim of internal dissensions in the management. The phenomenal growth and elevation and firm establishment of Purdue University in its present high position are almost entirely due to the efforts and influence of its president.

Addison C. Rand.

Mr. A. C. Rand, a brief notice of whose sudden and untimely death appeared in our last week's issue, was one of the pioneers in rock-drilling machinery, having been associated with the development of that industry almost from its beginning. As is well known, the Burleigh drill was the first one to become an operative success. The first work of any magnitude on which these or any other drills were employed on more than an experimental or trial scale was the Hoosac tunnel.

At that stage of development the different proposed and executed plans for rock drills were as diverse as were the early designs of locomotives, the history of rock drills in this respect being but a repetition of that of all radically new inventions. The human mind is unable to see very far beyond the limits of actual experience, and it seems inevitable that in work of this character, schemes must be proposed and tried which in the eventual outcome, and looking backward, seem to have been absurd.

Rock-drilling machinery is naturally associated with explosives, and to those engaged in the manufacture of explosives—which in those days meant what is now distinguished as black powder—came the various plans and projects for rock drills. Through his brother, Albert T. Rand, of the Laflin & Rand Powder Company, Mr. Rand had these projects placed in his hands for investigation. It is unnecessary to name these inventions now, as the verdict of time has set the seal of disapproval upon them, but it may be said that Mr. Rand's keen mechanical insight enabled him to foresee this ultimate judgment, and to condemn at least one scheme which had strong backing, and which was believed by many to be the correct solution of the problem.

Introduced to the subject in this way, he became interested in it, and soon became acquainted with Nutting & Githens, who were making, in a small way, the drill referred to in the biographical notice of Mr. Githens which appeared in our issue of January 11 last. This machine appeared to him to be an improvement on all the machines then known. His acquaintance with rock work and mining, through his connection with the powder business, led him to a full appreciation of the importance of the subject, and as Nutting & Githens were possessed of very limited capital, a business arrangement for the commercial handling of the machines soon followed, the present business having been organized in 1871 and incorporated in 1879.

Mr. Rand was born at the beautiful village of Westfield, Mass., in 1841. He came of distinguished Colonial and Revolutionary ancestry and was the son of Jasper Raymond Rand, who was a prominent man in Massachusetts public life, and one of the leaders in the Westfield industry of whip-making. It was in the manufacture of whips that Mr. Rand obtained his mechanical training and development. During the war of the rebellion he was acting Federal postmaster at Newbern, N. C.

In business Mr. Rand was held in more than respect by all his associates, while his integrity was spotless. Several of his associates in business were lifelong friends and boyhood companions. Others had been with him for many years—advancing step by step with the years and with experience—circumstances which make his death a blow such as is not often seen in like associations, and never where the relations are those of business only. This was, of course, accentuated by the extreme suddenness of his taking off. His most pronounced and best developed business faculty was, perhaps, his knowledge and judgment of men. This judgment seemed almost intuitive, and was seldom at fault, and through this it came about that no man ever succeeded in gathering about himself a more loyal or devoted set of associates than he. Personally, he was one of the kindest and most agreeable of men. His tact and urbanity were such that however much one might differ from him, to quarrel with him was impossible. In that kindly presence opposition simply melted away, and, without harshness, without dictation, almost without the exercise of authority, things simply went his way as a matter of course.

An enduring outcome of this spirit is the Engineers' Club of this city, of which he was one of the incorporators and the treasurer from the first. He had an enduring faith in the virtue of association and contact with one's fellows as an aid in dispelling much of the friction of life, and to further the operation of such influences among engineers, he labored for the success of the club, at a time when success was at least uncertain, as he did for nothing else, except his own business. The flag of the club was appropriately half-masted in his memory. He was also a member of the Union League, the Colonial and the Hardware Clubs of this city and of the Technical Club of Chicago. He was a member of the New York Chamber of Commerce, of the New England Society of New York, the American Society of Mechanical Engineers, the American Institute of Mining Engineers, a director of the Ninth National Bank and of the Laflin & Rand Powder Company.

Pratt & Whitney Company's Election.

T. J. Nicholl was elected vice-president of the Pratt & Whitney Company at the annual meeting, held March 15, at the office, succeeding Rowland Swift. He was connected with the management of the company as managing director last year. Mr. Swift held the vice-presidency only temporarily, and remains at the head of the executive committee, his associates being C. C. Cuyler, of New York; John R. Redfield, T. J. Nicholl and Amos Whitney. The other officers elected are: President, Amos Whitney; consulting engineer, Francis A. Pratt; secretary, R. F. Blodgett; treasurer, J. C. Stirling. The directorate contains one new name, that of J. B. Blackford, of New York, who is added to the board. All the other directors were re-elected.

Manufacturers.

Chas. W. Strong, Nyack, N. Y., maker of paper boxes, is putting up a new factory.

The Richmond Railway & Electric Company's plant, Richmond, Va., is to be enlarged.

The Michigan Anchor Fence Company is putting up a new factory building at South Haven, Mich.

The Leadville (Colo.) Electric Light Company is believed to be making plans to increase its plant.

W. A. Gill, Columbus, O., manufacturer of

stamped tinware, is to erect a new factory building on Cleveland avenue.

The Simplex Motor Vehicle Company, Salem, Mass., is a new corporation ($500,000 capital) to manufacture automobiles.

The New England Plumbing Supply Company, Springfield, Mass., will erect a six-story building for the manufacture of lead pipe.

A shipyard is to be established in Richmond, Va., by Chamblin & Scott for the construction of vessels of small displacement.

The Nichols & Shepard Threshing Machine Company, at Battle Creek, Mich., will erect an additional factory building in the spring.

The National Tube Company has lifted its first options on ground at Benwood, Pa., upon which it will build a plant to cost probably $2,000,000.

The Alabama Steel & Wire Company (capital $2,000,000) has started what is said to be the first steel rod wire and nail mill ever opened in the South.

The Kilbourne & Jacobs Manufacturing Company, makers of wheel-barrows, scrapers, trucks, sinks, etc., Columbus, O., will erect a new building, 100x420 feet.

The Marshall-Sanders Company, 301 Congress street, Boston, manufacturer of electrical specialties, has bought out the plant of the Anchor Electric Company.

The County Council at Indianapolis, Ind., has made an appropriation for a new powerhouse, together with a tunnel which is to connect the jail and court house.

The Detroit Bridge & Iron Works, Detroit, Mich., are having plans prepared for a factory building in addition to their present plant at a cost of about $16,000.

Peter Brady, Edward Dickey and H. F. Billinger, of Bellevue, O., representing a large carbon factory of Noblesville, Ind., are negotiating for a location of their factory at Lancaster, O.

P. & F. Corbin, New Britain, Conn., have obtained a permit to build a factory building on Orchard street. The building will be 285x45 feet, six stories high, and will accommodate about 600 workmen.

The iron works of J. Stanley Thorn, on the north side of Callowhill street, east of Thirteenth, Philadelphia, Pa., are to be increased by a manufacturing building, five stories high, "L" shaped, 60 by 112 feet.

The Consolidated Electric Light & Power Company, of Birmingham, Ala., is constructing a duplicate of its large plant, to furnish electricity for lighting and power purposes to Birmingham and its suburbs.

The Portland Iron & Steel Company, Portland, Me., recently incorporated with a capital stock of $75,000, is to operate a plant on the site of the old rolling mills which were recently burned. Charles T. Means, of Manchester, N. H., is president.

The Berlin Iron Bridge Company, of East Berlin, Conn., will open an office at Rooms No. 909-910, Stephen Girard Building, Philadelphia, Pa., on the 15th. The office will be in charge of Mr. L. H. Brumbaugh, who has been with the Berlin Iron Bridge Company for a number of years.

A. O. Ihlseng, of Carthage, Mo., is looking about for a new factory site, and has addressed communications to business men of Indianapolis, Richmond and other Indiana cities. He wants to locate a factory that will employ 100 people, for the manufacture of a clutch to be used with machinery of 10,000 horse-power and over.

Hench & Dromgold, York, Pa., manufacturers of agricultural implements, will erect a new boiler-house and stack, and are contemplating a 150x70-foot, three-story addition for carpenter shop, etc. They have already received a 150 horse-power boiler, a large lathe, a power riveter and other machinery. With their present capacity they find it impossible to keep pace with the growing demand for their goods all over the world.

The Empire Iron & Steel Company has practically concluded negotiations for the sale of its rolling mill at Oxford, N. J., to Janson Brothers, owners of an iron plant at Columbia, Pa. The rolling mill plant was purchased by the Empire Iron & Steel Company in connection with their furnace, which they will retain; but they never intended to operate the former. Mr. Frank Janson says that fifty men will be put right to work to get the plant in running order. It will be run on merchant bar iron.

(*Continued on page 59.*)

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant; see p. 32.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Forming lathes. Mer.Mach.T.Co.,Meriden,Ct.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Metal novelties, we buy and manufacture. Bliss Metal Co., Providence, R. I.

Will buy or pay royalty for good patented machine or tool. Box 228, AMER. MACHINIST.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies & Diemaking," $1, post paid. J.L.Lucas,Bridgeport,Ct. Send for index sheet.

Best of facilities for medium heavy work; contracts taken. Blanchard Mach. Co., Boston.

Selden Packing for Stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., New York.

Wanted—Second-hand boring mill; must be anywhere from 48 in. up in diameter of table. West Side Foundry Co., Troy, N. Y.

For Sale—Patterns for 25 machines; goodwill 25 years' standing. F. Gleason, American & Susquehanna ave., Philadelphia, Pa.

For Sale—New Barnes 13 in. lathe, velocipede foot power, also countershaft, tools, etc. Address. "K. S.," AMER. MACHINIST.

For Sale—Two geared Ferracute presses, 62 in. between uprights; little used, and in good condition. Address W. H. Mullins, Salem, Ohio.

Threads and gears; easy rules to cut any thread possible to be cut in the lathe, without algebra, sent to any address for 25c. by G. W. Dixon, Spring Lake, Mich.

Wanted—One or two good second-hand hydraulic jacks of large capacity; give make, condition and price. Address "Hydraulics," care AMERICAN MACHINIST.

An experienced pump designer will furnish full detail blueprints to any concern desiring to build duplex pumps up to 7½x4¾x10 in. For information and price, address Box 270, AMERICAN MACHINIST.

Institutions retiring from business having machine tools, brass and wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

Wanted—Partner with capital, by experienced mechanic; start foundry and machine shop; cheap fuel; free site; salable products; opportunity for broad-gage man with ambition, integrity and "sand," to build from moderate commencement business of magnitude. Address Box 259, AMER. MACHINIST.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

Draftsman wishes position in South America or Mexico; 6 years' exp. Box 257, A. M.

Young man wishes position in mechanical drawing room, having had two years' experience. Box 265, AMERICAN MACHINIST.

A superintendent of machine and engine shop wishes to make a change; capable of handling 500 men. Box 248, AMER. MACH.

First-class mechanical draftsman, graduated, 4 years' experience designing and construction, wants position. Box 266, A. MACH.

Wanted—Position as construction man on outside work preferred, by first-class machinist, also draftsman and mechanical engineer. Box 263, AMERICAN MACHINIST.

Young man, with two years' experience in an architect's office and some mechanical experience, desires position with some locomotive works or machine company, as draftsman; best of references. Box 264, A. MACH.

Want to take charge of casting department for large manufacturing concern who handle quantity of work; experienced in foundry work, ordering, and knowledge of prices; 31 years of age. Address "System," AM. MACH.

Mechanical engineer with office and road experience wants position with compressor manufacturer; thorough experience with air lift for pumping artesian wells; excellent references. "Pneumatic," care AMER. MACH.

A mechanical engineer of large and varied experience as designer and chief draftsman, and possessing executive ability, wishes to make a change, and invites correspondence with any firm that requires the services of such a man at a good salary. Address Box 269, AMERICAN MACHINIST.

Position Wanted.—Young man of 28, as cost clerk, etc.; has had 5 years' experience as cost clerk, purchasing agent, etc., with large manufacturing concerns, both electrical and machine; thoroughly acquainted with modern shop cost systems, and is capable of correcting wrong methods; would be willing to accept position at low figure to prove his value; highest references. Address "Barnes," care AMERICAN MACHINIST.

Help Wanted.

Twenty first-class machinists wanted; steady work. Address Weber Gas & Gasoline Engine Co., Kansas City, Mo.

Wanted—Man to take charge of office and estimate department in large engine works. Box 233, AMERICAN MACHINIST.

Wanted—A good man experienced in making dies and tools for sheet-metal work and shop repairs. Conklin Mfg. Co., Atlanta, Ga.

Wanted—Draftsman accustomed to stationary engine work; steady employment and good wages. Box 232, AMERICAN MACHINIST.

Wanted—First-class draftsman on Corliss engine work; state experience and salary wanted. Weimer Machine Works Company, Lebanon, Pa.

Draftsman wanted; must be familiar with and have had experience in machine designing. Automobile Company of America, Marion, Jersey City, N. J.

Wanted—A first-class metal pattern maker; one who has had experience on valves; none but experts need apply. H. E. M., care AMERICAN MACHINIST.

Wanted—Experienced man to lay out work for shop and do estimating on all styles of gear cutting. Address, stating terms, "Gear," care AMERICAN MACHINIST.

Wanted—Experienced mechanical draftsman on high-speed engine work; permanent position to the right man. Address Fischer Foundry & Machine Co., Pittsburgh, Pa.

Experienced draftsman wanted on mill machinery and machine tools; permanent employment assured to rapid and accurate draftsman. Box 260, AMERICAN MACHINIST.

Wanted—First-class field foreman, competent to erect stand-pipes, pen-stocks, steel stacks, etc.; state wages and references. Address "Field Foreman," care AMER. MACH.

Draftsman wanted, experienced in designing new machinery; state years of experience, age, salary expected, character of work employed at. Address Box 262, AMER. MACH.

Machinists on slotters, milling machines, tool making and fitters, wanted; good wages and permanent position to first-class men. Samuel L. Moore & Sons Co., Elizabeth, N. J.

A number of toolmakers and skilled machinists wanted, also several foremen in our machine department at our shops, Marion, Jersey City, N. J. Automobile Company of America.

Wanted—By a company located in the East, two good draftsmen with some ability as designers, who have experience in the line of steam engineering. Address Box 253, AMERICAN MACHINIST.